ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

AUGUST 1956

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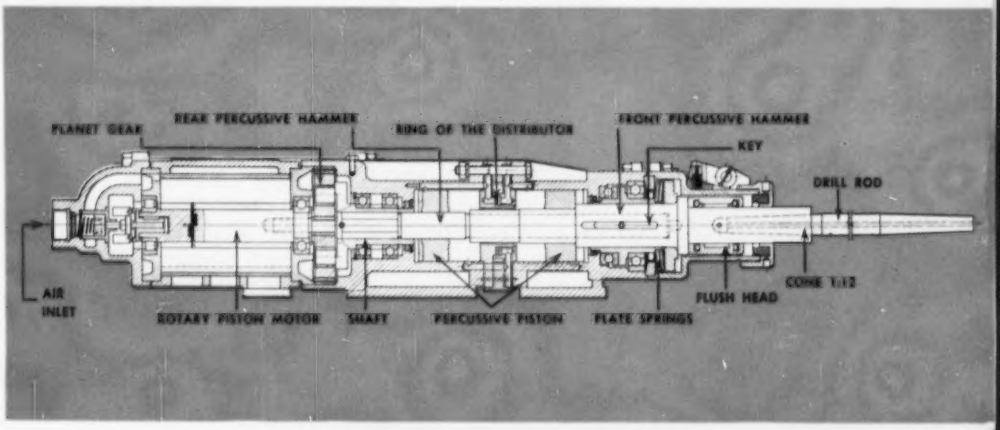
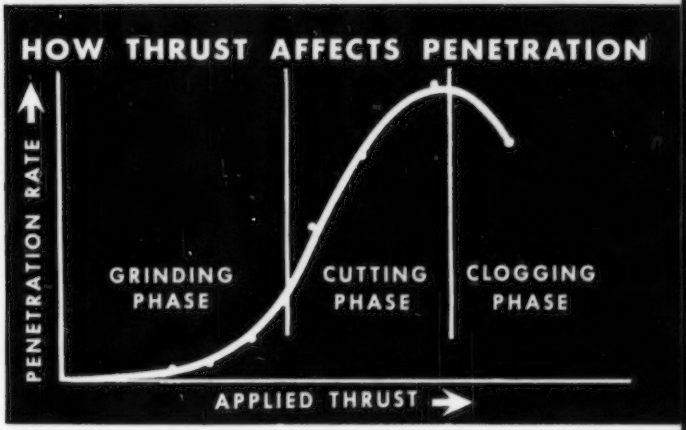
FOUNDED 1866

Rotary Percussive Drilling





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The new look

IN SLURRY PUMPS

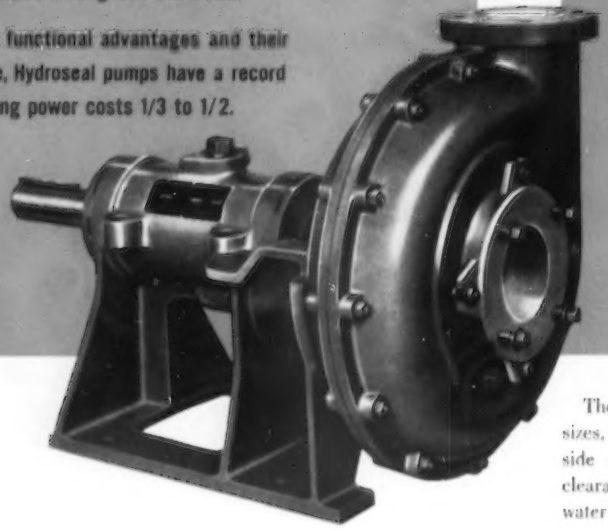
Efficiency with economy through Hydrosealing

Deliver pulp UNDILUTED

HYDROSEAL

THIS split-shell version of the old Hydroseal Slurry pump is a new companion of Hydroseal Sand and Hydroseal Dredge pumps—famous for superior service in mining fields throughout the world.

Besides functional advantages and their long life, Hydroseal pumps have a record of cutting power costs 1/3 to 1/2.



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THIS industrially-efficient complement to the Hydroseal Slurry is meeting enthusiastic acceptance where abrasive, corrosive pulps must be delivered undiluted

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. . . cement manufacturing
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nasty corrosive slurries.

These rubber-lined Slurry pumps are made in seven sizes, each identical except their impellers and engine-side shell half-liners. In the Hydroseal, the close clearances are protected from abrasives by sealing water; in the Centriseal, by impeller auxiliary vanes.

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LOW-COST AIR POWER

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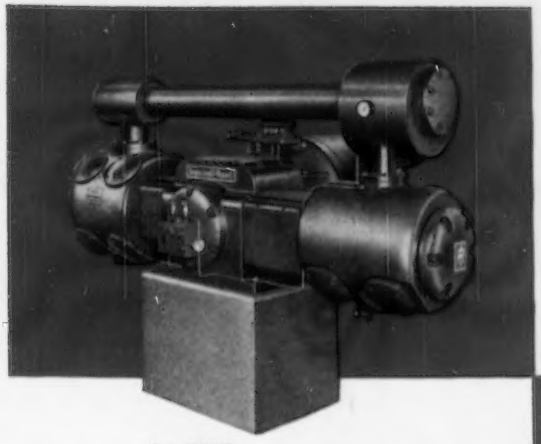

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- 75 and 100 hp packaged
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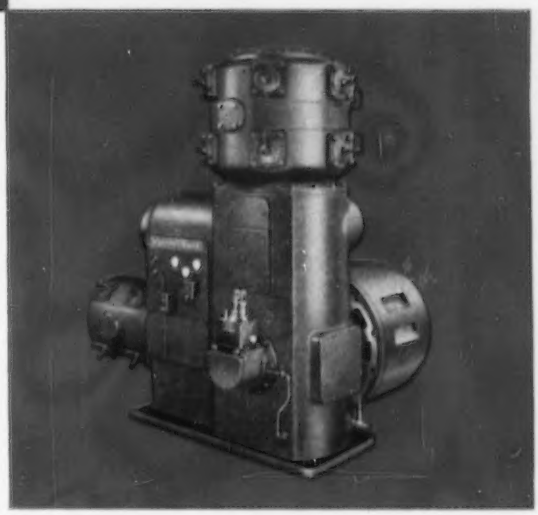

the XLE
- 125 to 250 hp packaged
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Why MODERN I-R DESIGN can reduce your air power costs and increase your production

Built tough for continuous full load, and refined for efficient performance at all loads.

Packaged, ready to run, each unit completely self-contained with crankshaft-mounted motor. Units up to 250 hp are shipped fully assembled, ready to hook up.

Full-floating aluminum bearings are foolproof, never need adjustment. They "roll with the punch" of every compressor stroke. Wear is distributed evenly around both inside and outside.

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Exceptionally smooth running balance permits small, simple foundation.

Compactness permits installation in small areas, requiring less of your valuable shop space.

CHANNEL VALVES give quiet, trouble-free operation and amazing long life due to air-cushioned action and reversible seat plates. Known all over the world for their efficiency, these valves are entirely different in design and principle from any other valve ever used. Channel valves are available only in I-R compressors.

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90th YEAR OF PUBLICATION

VOL. 157 NO. 8

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LETTERS

Engineering Opportunities

You have heard much lately about the shortage of mining engineering graduates. However, a few brief statistics on the 51 companies and organizations contacting us for graduates during the past year may be of interest to you.

Following is a functional classification by type of this group:

Coal mining	12
Hard rock mining	15
Oil and gas	9
Manufacturing	5
Government	5
Others	5
Total	51

The number of companies or agencies in each category does not tell the complete story as some may have hired the entire class of seven graduates. Also, many (steel companies) interview for more than one type of work.

It is estimated conservatively that at least ten job opportunities exist for each graduate mining engineer. In order to improve the situation, we are recommending industry-supported scholarship programs for qualified high school graduates.

Typical of the method used to publicize these awards is an announcement of the Joy Manufacturing Co.'s $1,000 freshman scholarship in mining engineering. The announcement states: "A critical shortage of mining engineers exists. . . . The scholarship winner is assured summer employment with the Joy Manufacturing Co., and will be reviewed for permanent employment after graduation. However, he is not obligated to work for Joy."

A. W. Asman, Head
Department of Mining
Pennsylvania State University

● For full details on this scholarship, write Mineral Industries Scholarship Committee, Mineral Sciences Building, University Park, Pa.—Ed.

Ahead of the Game

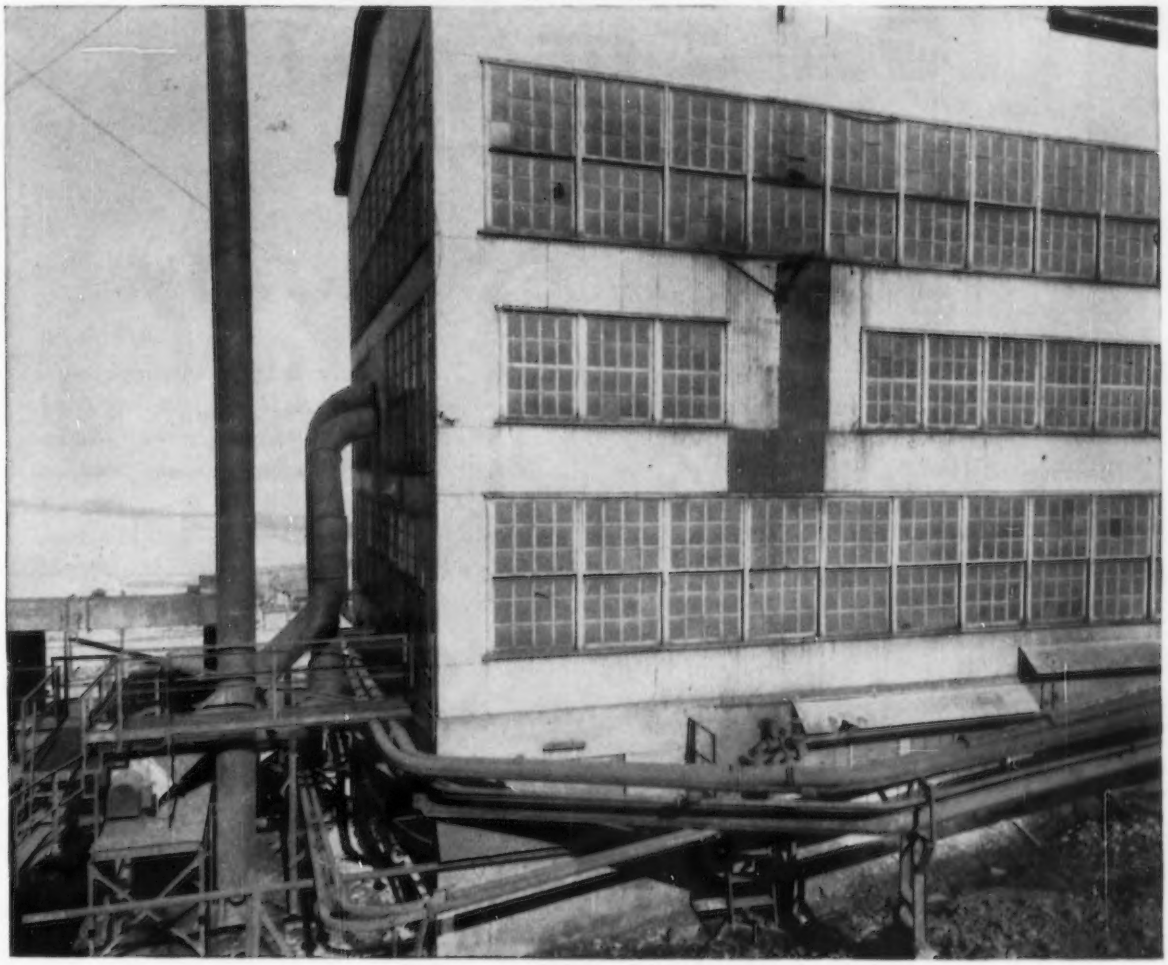
In your issue for June, pp 75 et seq., there is an article, "16 Ways to Protect Trolley Locomotive Operators."

It may well be of interest to your readers that the Braden Copper Co., in Chile, had in operation 25 or even 30 years ago, mining locomotives on a 30-in. gage track, embodying, inter alia., air brakes, dynamic braking, contactor control, dead man's handle, plus, later, safety foot pedal, as well.

Some of these features were used in tandem—articulated units, all in double-truck units. Reasonable protection for the operator was provided—as a matter of course.

A. J. Noerager
Palo Alto, Calif.

B.F.Goodrich



Rubber artery with a pounding pulse

A typical example of B. F. Goodrich improvement in rubber

SHOOTING through that long pipeline is hot, roasted molybdenum on its way to cooling tanks. It used to travel through iron pipes. But the lime in the mixture would stick to the metal, build up thick deposits, slow down the flow to a trickle. The plugged pipe had to be replaced at least once a year, sometimes more often.

When a B. F. Goodrich man heard of the problem, he suggested that rubber hose take the place of the troublesome pipe. He had in mind a B. F. Goodrich hose, made with a special rubber lining that resists acids and a tough rubber-and-fabric body to stand the pumping pressure. What's more, he knew this B. F. Goodrich hose would be flexible enough to expand and contract with the pump pressure, like a pulse beat in an artery, and so break off lime deposits as fast as they would form.

This B. F. Goodrich hose was tried, and worked perfectly. No reduction in flow whatsoever. In use almost continuously 24-hours-a-day, 7 days a week, the hose has outlasted pipe *10 to 1*. There are even some lengths on this job after 15 years service!

Improvements are constantly being made in all kinds of B. F. Goodrich hose to make them last longer, stand more abuse, handle easier, and cost less. Your B. F. Goodrich distributor is an expert at solving hose problems. Call him when you need help, or write *B. F. Goodrich Industrial Products Co., Dept. M-710, Akron 18, Ohio.*

B.F.Goodrich

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Get a head start toward greater economy

LUBRICATE mine car wheels with *Texaco Olympian Grease.* You'll get smoother, easier starts, get more tonnage out faster, pocket a sizable saving in maintenance costs.

Texaco Olympian Grease assures smooth, easy starts the year 'round. It *stays in* wheel bearings—gives extra protection against dirt, moisture and wear. Moreover, it has a high oxidation resistance, won't separate in use or storage.

You can get *Texaco Olympian Grease* in three consistencies—for every requirement of plain, cavity hub or anti-friction bearings.

To fully protect and lubricate wire rope and open gears, use *Texaco Crater.* It keeps wire rope strong longer by preserving strands and core—prolongs gear life by cushioning shocks and heavy loads. For liquid application on both wire rope and gears, use *Texaco Crater X Fluid.*

Find out how specialized Texaco Lubricants and Lubrication Engineering Service can raise your operating efficiency, cut your maintenance costs. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

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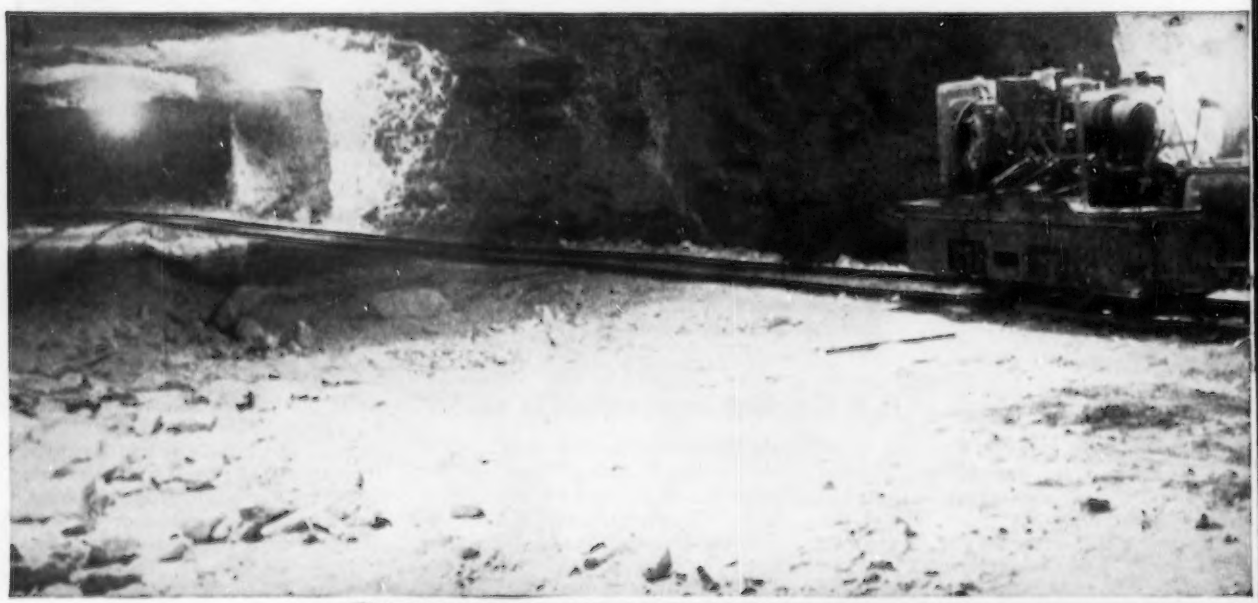

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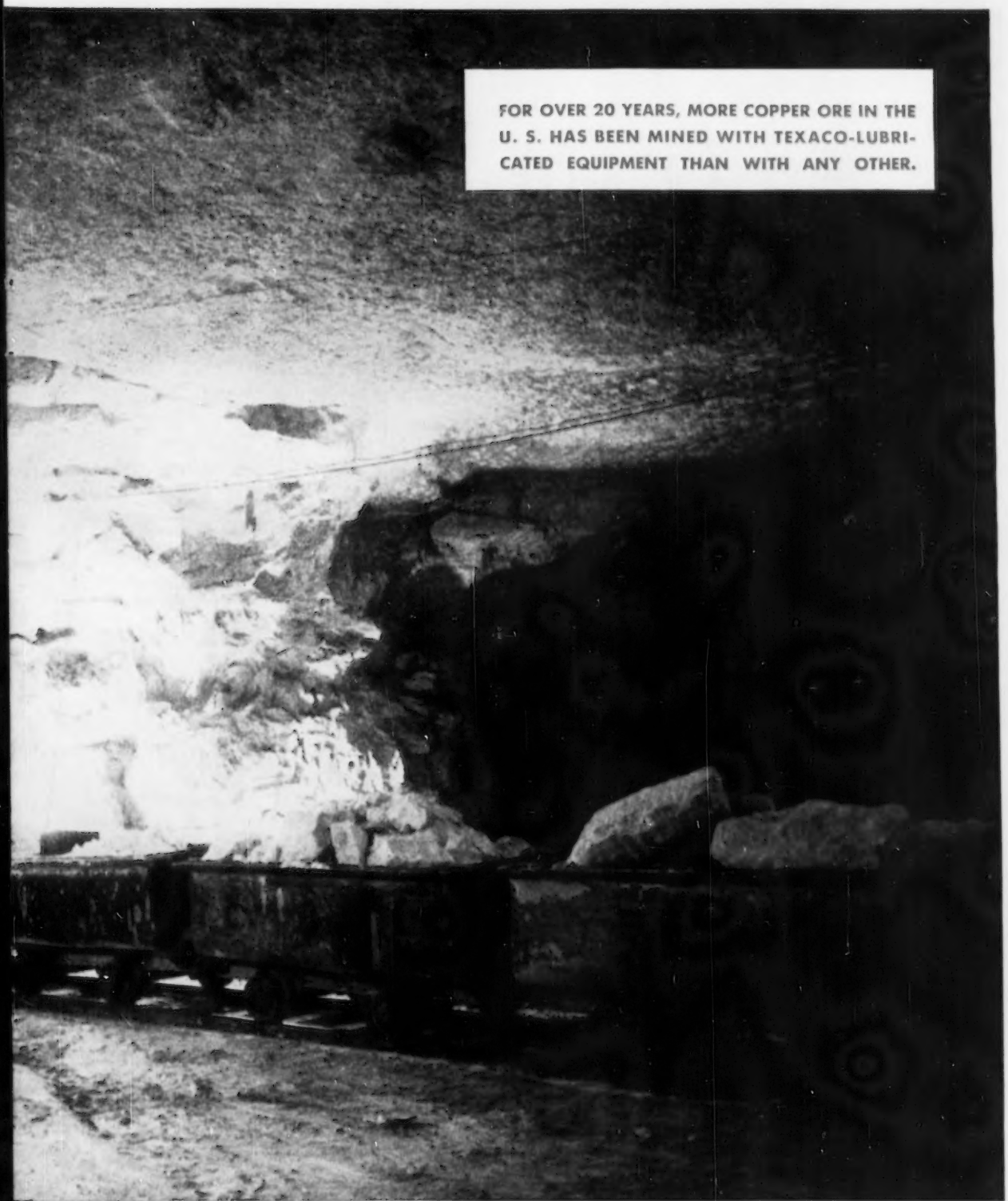
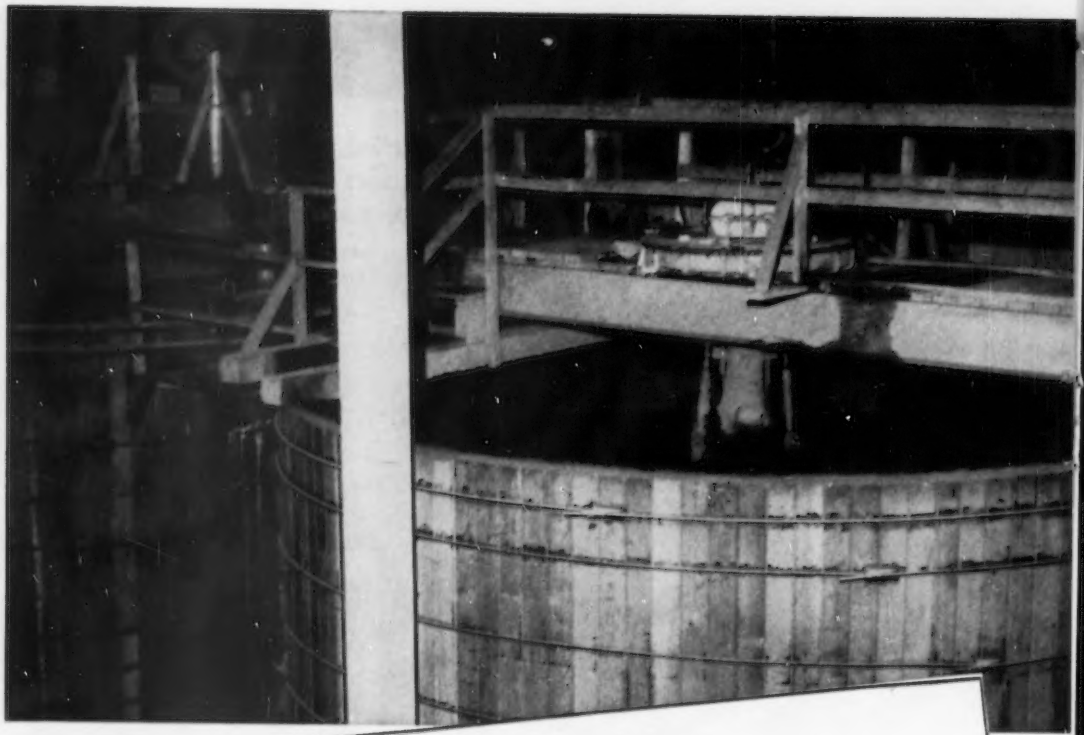


Lubricants and Fuels

FOR THE MINING INDUSTRY



Two of the twelve Dorr Agitators installed at Gunnar.

URANIUM PRODUCTION AT GUNNAR MINES LTD.

One of the early Uranium producers in North America, Gunnar Mines Limited at Uranium City, Saskatchewan selected Dorr-Oliver-Long equipment for above and below ground operations from our Associate Company in Canada. For the *leaching section* twelve acid resisting Dorr Agitators are installed, each 20′ dia. by 20′ deep. For the *neutral circuits* four 3-compartment Dorr Tray Thickeners are used, each 50′ dia. by 23′ deep and two 8′6″ dia. x 7 Disc American Filters. For *final residue washing*, six Oliver String Discharge Filters are employed, each 11′ 6″ x 16′ face with acid resisting construction. In the *precipitation section* is the first Rubber Lined Sweetland Filter ever built.

Now an open pit operation, Gunnar plans a new shaft in the near future and has ordered from Dorr-Oliver-Long the front dump skip, cage, head sheaves and Granby type mine cars.

For more information on the complete line of D-O equipment for the mining industry, write to Dorr-Oliver, Stamford, Connecticut.

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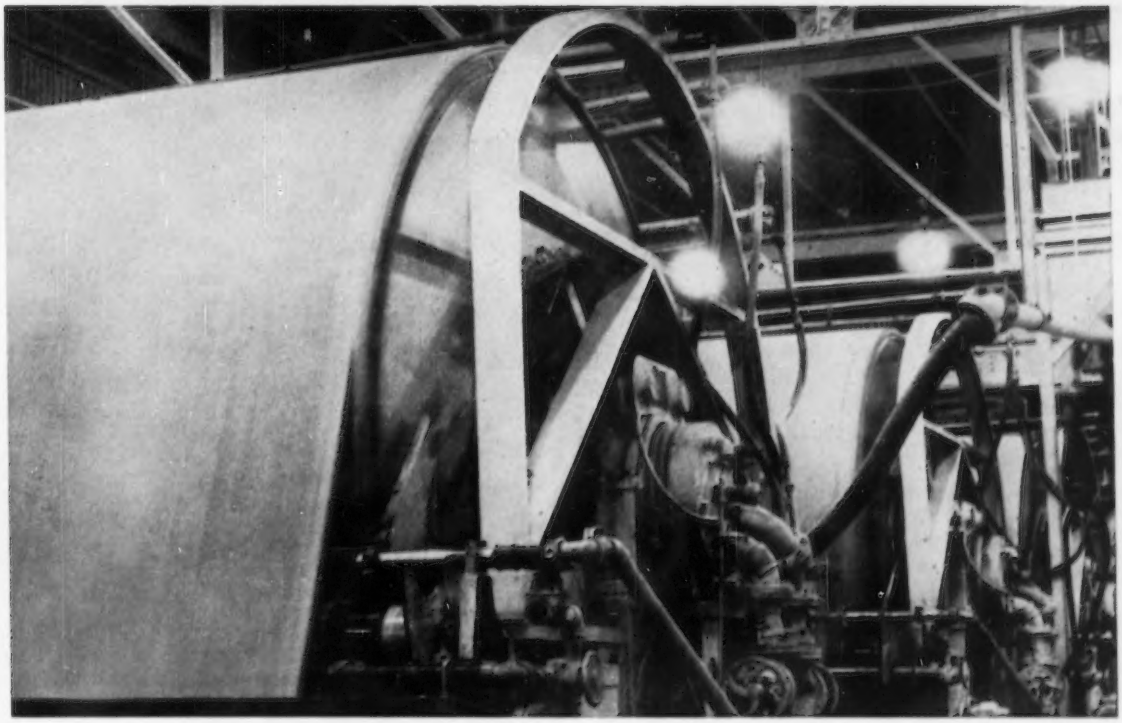
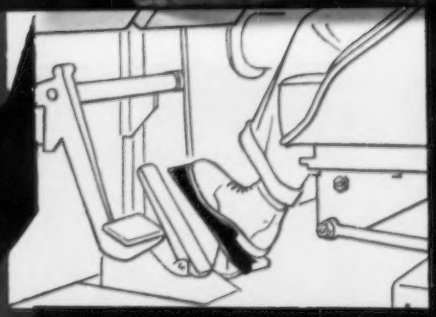
Closeup of one of the Tray Thickeners showing drive mechanism and feeding arrangement.



Three of the six Oliver String Discharge Filters. Three additional Filters have since been ordered.

Photographs by J. Wilson, Gunnar Mines Ltd.

PUSH THIS PEDAL...



Payhauler® Bonus-

Try it

This new Model 95 Payhauler is carrying 24 tons of shovel-loaded limestone over the quarry floor, up the ramp to the crusher. A 4-speed torque converter transmission provides smooth speed changes and gives direct-drive performance through a lock-up clutch design. The Model 95 is also available with a 9 speed conventional transmission.

Try load-highballing turbo-charged diesel power in either the new 24-ton Model 95, or 18-ton Model 65 International Payhauler—with highest hp-per-ton of any similar-size off-highway trucks. Turbo-charging keeps cargo-power high, engine weight per hp low, cuts fuel costs 10%, or more—reduces upkeep.

Try the big-load-handling advantages of heat-defying, smooth-applying International Cerametallic clutch facings. No other clutch in any off-highway hauler gives such power-transfer efficiency, operating ease, or long life.

Try Payhauler "load-cradling", speed-gaining design! Semi-elliptic, multiple-leaf, free-floating springs swallow the "rock-shock" of big-shovel loading—and the mauling of 36 or 38 mph speeds. And brawny Payhaulers have the strongest main frames known of any off-highway haulers.

Try picture-window vision, ahead and to sides. Offset cab gives clear back-up view. Try changing speeds by *power-shifting*—steer with *power-steering*—dump with fast, responsive *power-hoisting*. You ride in "spring-hydraulic" cushioned seat comfort—fuel-up once daily! Try *new* Payhauler job efficiency! Have your International distributor give you a demonstration today!

Try new International® Powered performance

Try it..

Try a new Dirt-Heaping, Bid-Beating International Payscraper®. Overburden comes off fast when there's a high speed International Payscraper doing the stripping. A twenty-yard load takes less than a minute for the Model 75 Payscraper shown here with an International TD-24 push tractor. Compare payload-boosting Payscraper production to any other two- or four-wheel unit. See your International Construction Equipment Distributor for a demonstration today!

Try it..

Try new Bonus-Powered International crawler advantages! Try seconds-fast, true *in-seat* International gasoline conversion diesel starting—now standard equipment in all crawler models. Size-up the advantages of "control-tower" job vision—new booster steering ease—new Cerametallic clutching ease and efficiency—new 480-hour lube oil filters. Prove how bonus-powered performance boosts production, simplifies servicing! Try one, on your job.

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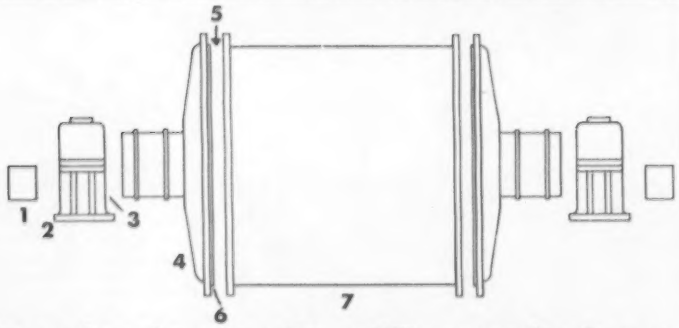

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3. Self-aligning ball and socket trunnion bearings.
4. Meehanite Metal heads . . . Meehanite's uniform density, high tensile strength, fatigue strength, rigidity and impact strength provide qualities of toughness and resilience.
5. Heads are separate from shell . . . if a trunnion is damaged you do not have to replace entire mill. Trunnions can be furnished separate from heads.
6. Male and female fits on flanges take shear off of bolts and assure proper alignment.
7. Heavy plate steel shell.

Gears have cut teeth, are split and reversible.

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Three characteristics give J&L CenterFit Wire Rope the staying power to develop outstanding service in applications where shock, fatigue and heavy loading limit the service life of standard wire rope.

1. CENTERFIT is the strongest standard rope produced.
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3. CENTERFIT has unsurpassed resistance to shock loading.

Over the years CenterFit has built a record for outstanding service life on the toughest applications such as shovel hoist ropes, back hoe pull ropes, and clamshell holding and closing lines where overloading is a factor. Contact your nearest J&L Office or representative.

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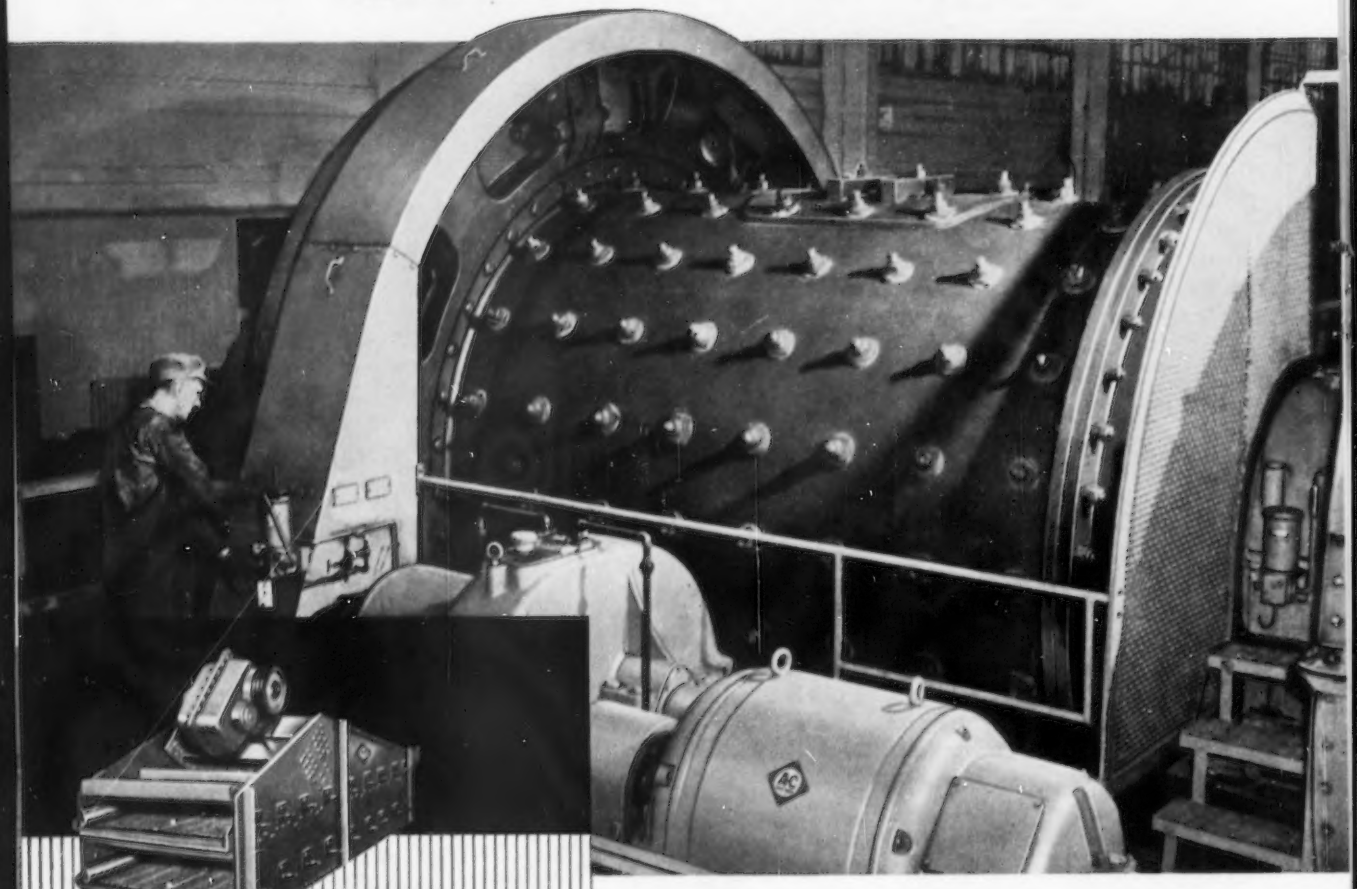

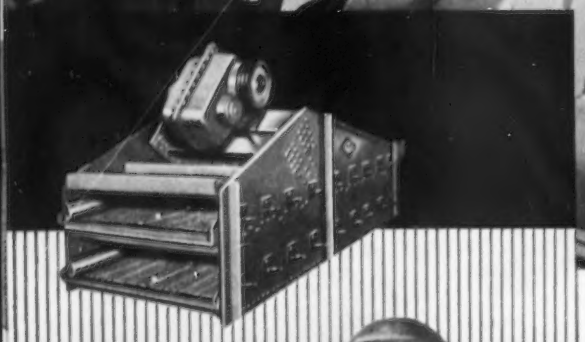

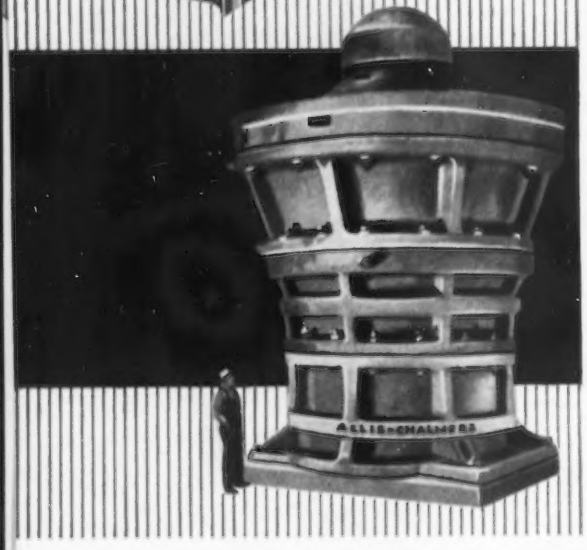

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GRINDING MILLS—Whether your process calls for individual mills or a grouped stage grinding series, Allis-Chalmers can make a right-for-the-job recommendation from seven different types of grinding mills.

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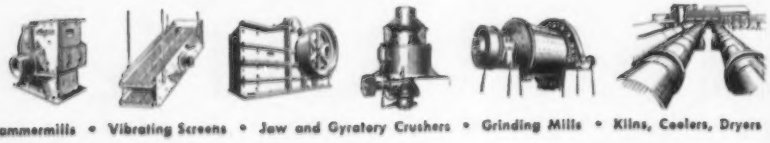

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The utilization of this experience and intimate knowledge of your requirements has, of course, influenced the outstanding development and advanced design of Allis-Chalmers equipment. But more than that, these factors, combined with A-C diversification, have made possible the "coordineering" of related equipment in smooth, profitable processing arrangements in plants everywhere.

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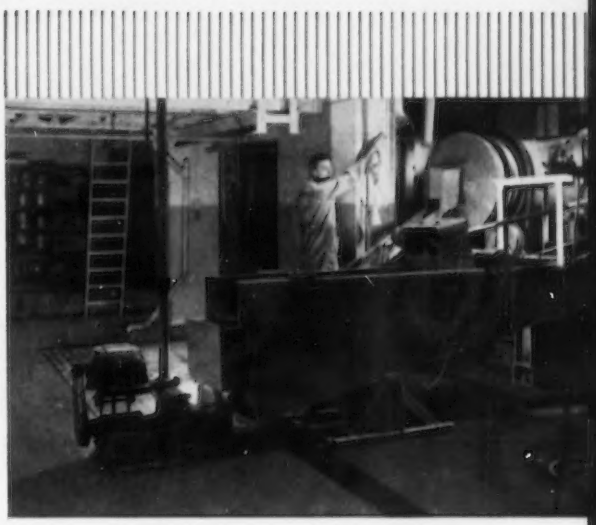

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FIRM Bagdad Copper Corp., Bagdad, Arizona

Biggest truck in the world uses RPM DELO Oil!

246,000 POUNDS TOTAL LOAD, 48 tons of truck and 75 tons load, are hauled out of the Bagdad Copper Corp.'s ore pit at Bagdad, Arizona, by the two 350 h.p. supercharged diesels in this unit. RPM DELO Special Lubricating Oil is used in the engines as specified by Mr. Ernest Dickie, General Manager of Bagdad, on the basis of his years of experience with RPM DELO Oils in many other heavy-duty engines.

The big truck, described as the largest in the world, was designed by Mr. Dickie and engineers of Dart Truck Co., builders. Power is transmitted through 3-stage torque converters. All controls are powered.

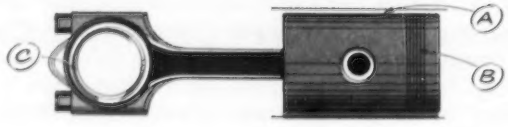
FREE FOLDER tells you about all the RPM DELO Oils and how they meet every heavy-duty engine condition. Write or call for it today.

FOR MORE INFORMATION about petroleum products of any kind or the name of your nearest distributor, write or call any of the companies listed below.

RPM DELO LUBRICATING OILS

TRADEMARK "RPM DELO" REG. U. S. PAT. OFF.

How RPM DELO Oils reduce wear, corrosion, oxidation in all heavy-duty engines



A. Contain special additives that provide metal-adhesion qualities...protect parts whether hot or cold, running or idle.

B. Anti-oxidant resists deterioration of oil and formation of lacquer...prevents ring sticking. Detergent keeps parts clean...helps prevent piston scuffing.

C. Special compounds stop corrosion of any bearing metal and foaming in crankcase.

STANDARD OIL COMPANY OF CALIFORNIA
225 Bush Street • San Francisco 20, California

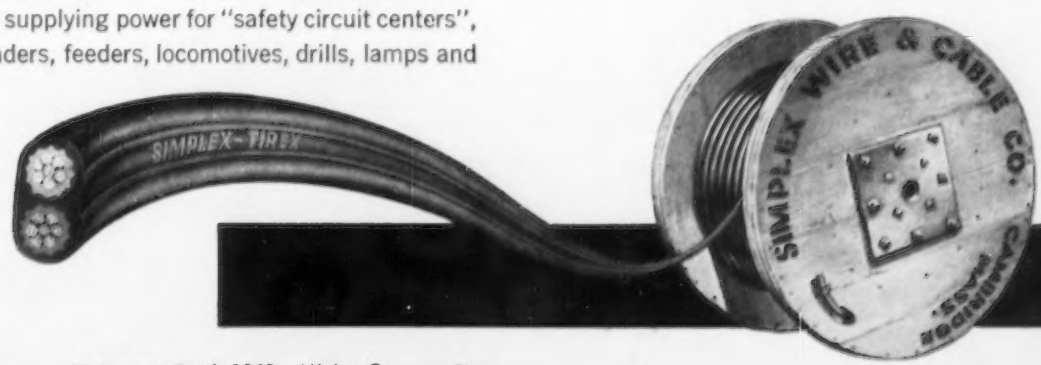
THE CALIFORNIA COMPANY
P. O. Box 780 • Denver 1, Colorado

STANDARD OIL COMPANY OF TEXAS
P. O. Box 862 • El Paso, Texas

A-5114

Margin for error: None

Mining, because of its very nature, requires "something extra" on the part of both men and equipment. Ruggedness and reliability are especially important, and it is this fact that accounts for the widespread preference for Simplex — TIREX cords and cables. These expertly engineered cords and cables, featuring exclusive CURED-IN-LEAD SELENIUM NEOPRENE ARMOR, are extremely flexible, and resist abrasion, oil and water. They are "on the job" in mines everywhere, dependably and safely supplying power for "safety circuit centers", for loaders, feeders, locomotives, drills, lamps and other items of equipment. Simplex-TIREX bears the molded markings of P-101-BM on its jacket, signifying acceptance by the U. S. Bureau of Mines, and approval of the Dept. of Mines, Commonwealth of Pennsylvania. Available in a wide range of sizes, at most mining houses and electrical distributors. Play safe whenever you order cords and cables — specify Simplex-TIREX! **SIMPLEX WIRE & CABLE CO.,** 79 Sidney Street, Cambridge 39, Mass.



LIVE BETTER ELECTRICALLY

Visit us at Booth 1048—Mining Congress Show

ENGINEERING REPORTS:

Powered by General Electric system . . .

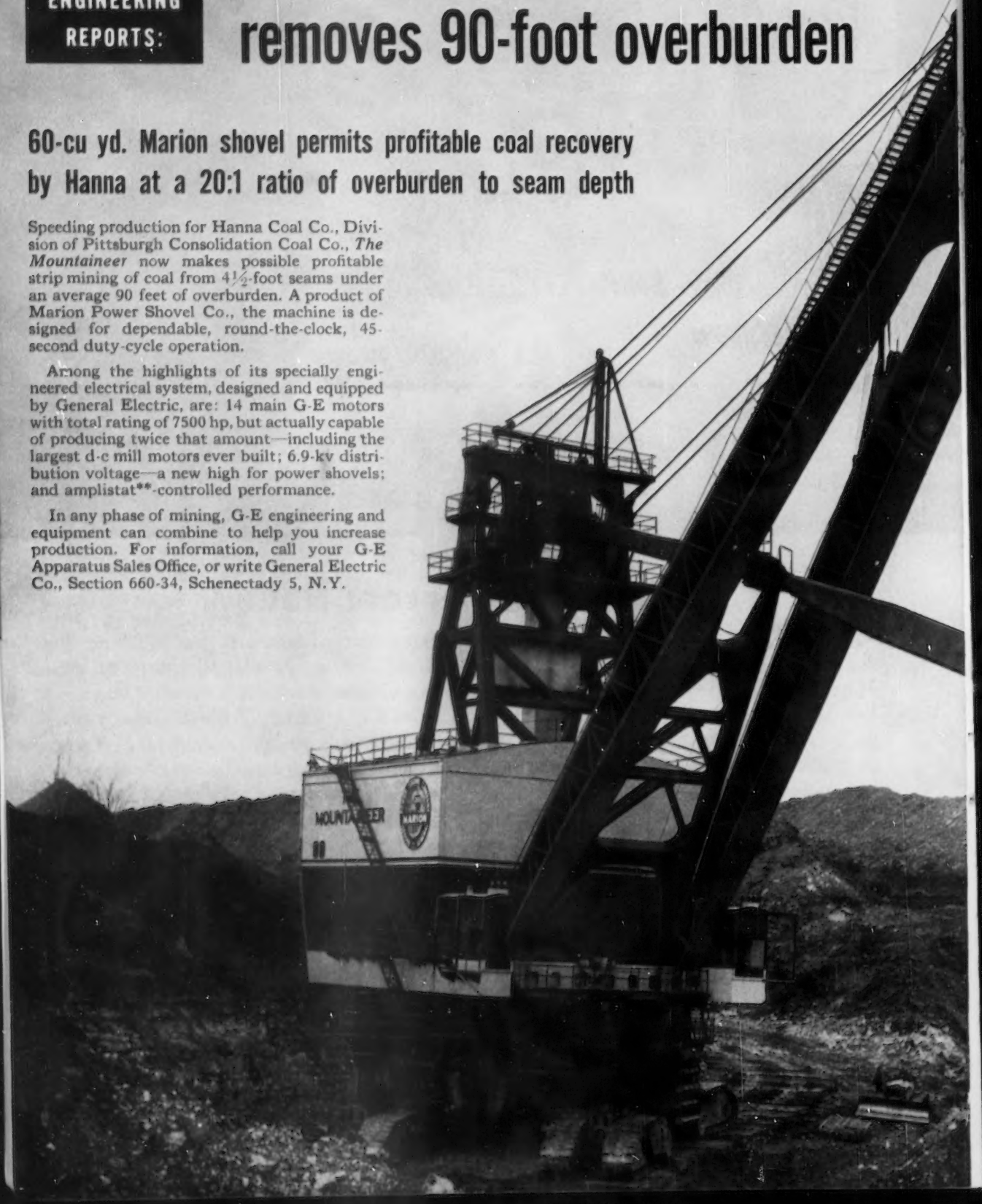
World's biggest shovel removes 90-foot overburden

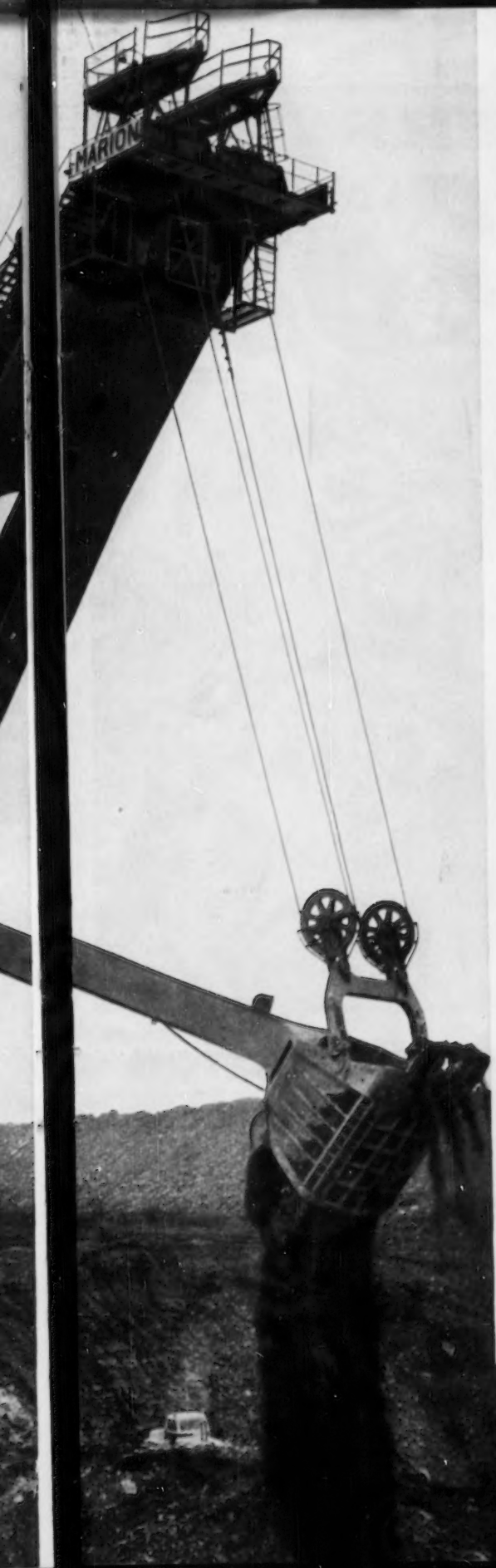
60-cu yd. Marion shovel permits profitable coal recovery by Hanna at a 20:1 ratio of overburden to seam depth

Speeding production for Hanna Coal Co., Division of Pittsburgh Consolidation Coal Co., *The Mountaineer* now makes possible profitable strip mining of coal from 4½-foot seams under an average 90 feet of overburden. A product of Marion Power Shovel Co., the machine is designed for dependable, round-the-clock, 45-second duty-cycle operation.

Among the highlights of its specially engineered electrical system, designed and equipped by General Electric, are: 14 main G-E motors with total rating of 7500 hp, but actually capable of producing twice that amount—including the largest d-c mill motors ever built; 6.9-kv distribution voltage—a new high for power shovels; and amplistat**-controlled performance.

In any phase of mining, G-E engineering and equipment can combine to help you increase production. For information, call your G-E Apparatus Sales Office, or write General Electric Co., Section 660-34, Schenectady 5, N.Y.





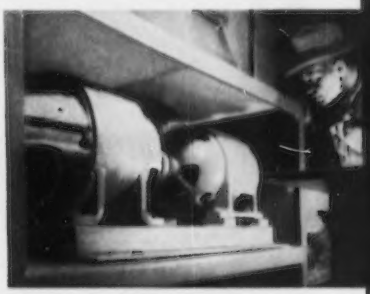
G-E ANALOG COMPUTER enabled engineers of Hanna, Marion, and G.E. to complete in two weeks calculations on design and performance that might have taken three years.

4 RUGGED G-E vertical armored d-c motors, developing 1900 hp, give top performance on high-capacity, heavy-duty swing-motion.

HIGH DEPENDABILITY on a demanding application is provided by four G-E d-c mill motors developing 5000 hp for hoist-motion, equipped with Tri-Clad '55'† blower motors.

SHOCK-RESISTANT G-E armored motors, atop frame, power crowd-motion. Sturdy design helps assure long life on rugged duty.

ABUNDANT DC POWER for operating needs is supplied by two large G-E motor-generator sets. Synchronous motors drive seven generators, which develop 6000-kw peak output.



FINGER-TIP CONTROL of operating functions is provided by adjustable-voltage system with responsive G-E Amplidynes*.

SPEED CONTROL with protection from heavy impact loads during repeated bucket loading, plus simple one-man operation is provided by reliable G-E amplistat control panel.

PROPELLING SHOVEL, four 250-hp G-E wound-rotor motors, powering 8 crawlers, are controlled at second operator station.

*The Amplidyne—rotating amplifier developed by General Electric.
**Amplistat—static amplifier developed by General Electric Co.

†Reg. trade-mark of General Electric Company.

Engineered Electrical Systems for the Mining Industry

GENERAL ELECTRIC

ALLIS-CHALMERS

new TS-260

power-matched for production

power-matched to capacity With more than 18 horsepower for every yard of struck capacity, the new TS-260 has plenty of power to move full loads at full speed—under all conditions.

power-matched to strength The TS-260 has the structural strength and balance to effectively utilize all of its horsepower . . . with extra capacity built into the clutch, transmission, final drives and drive axles . . . with a heavy, all-steel, box-type tractor frame . . . and with proper over-all weight distribution.

Motor Scraper

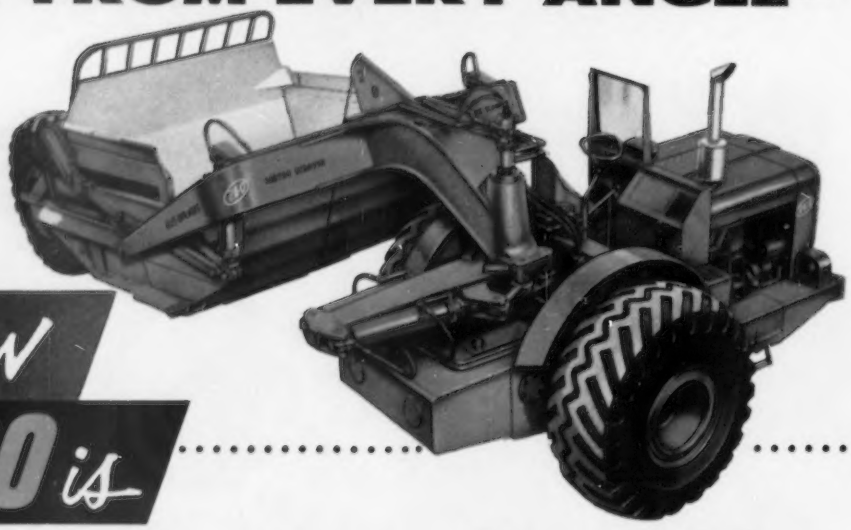
and profit on the job!

power-matched for speed The big Allis-Chalmers diesel engine provides high torque at both high and low engine speeds resulting in smooth shifting and fast acceleration. And with plenty of engine power, the TS-260 loads fast, hauls fast, dumps fast . . . moves big payloads at low cost, even under tough conditions.

power-matched for operating ease Overlapping gear speeds in all four gear ratios reduce gear shifting, speed work cycles. And with 90-degree steering for rapid maneuvering in close quarters, it's easy for the operator to get the most out of the TS-260.

The new TS-260 gives you these four basic advantages . . . and many important new features

CHECK IT FROM EVERY ANGLE—



the New TS-260 is—

Designed for Low-Cost Dirt

"Live action" hydraulics for sure control. Positive gear-driven pump provides constant live power for both steering and scraper operation. Full-flow filtering, cross relief valves and simple design make this an efficient, safe performer.

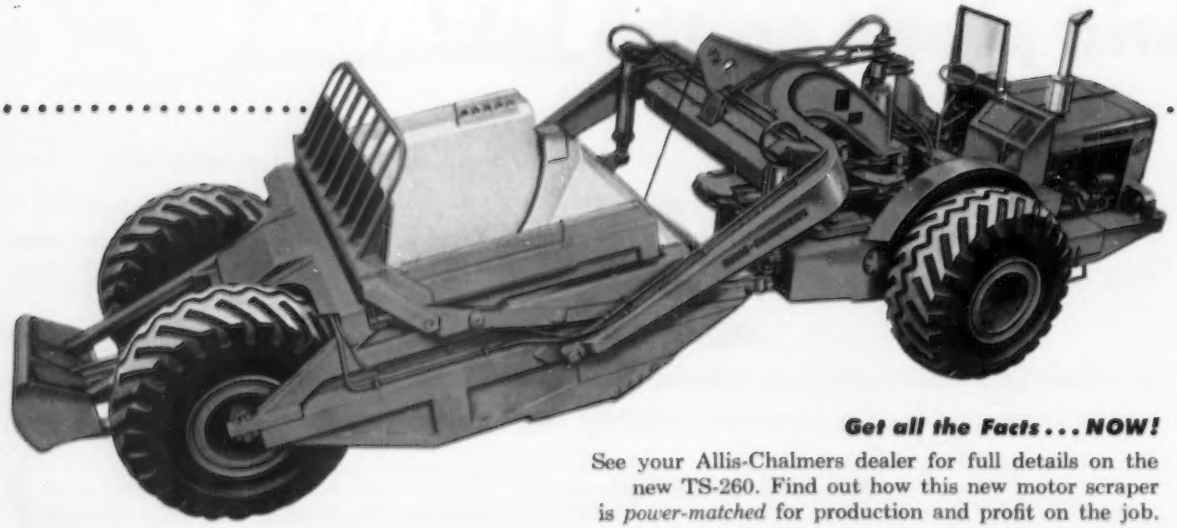
Positive 90-degree steering for close-quarter maneuverability. The steering wheel is direct-link connected to the steering valve. A 30-degree turn of steering wheel directs full pump flow to two double-acting steering jacks for fast, positive turns up to 90 degrees. For slower turning at high speeds, a slight turn of steering wheel provides a smooth, regulated response.

Double-safety brakes for positive stops. Big, four-wheel air brakes provide sure braking under full load at full speed . . . and an air reservoir system with emergency relay valve means positive braking safety.

"Boiling-action" loading for big payloads. Combination of curved bowl bottom and offset cutting edge provides a "boiling" action that eliminates voids . . . builds profitable, heaped loads.

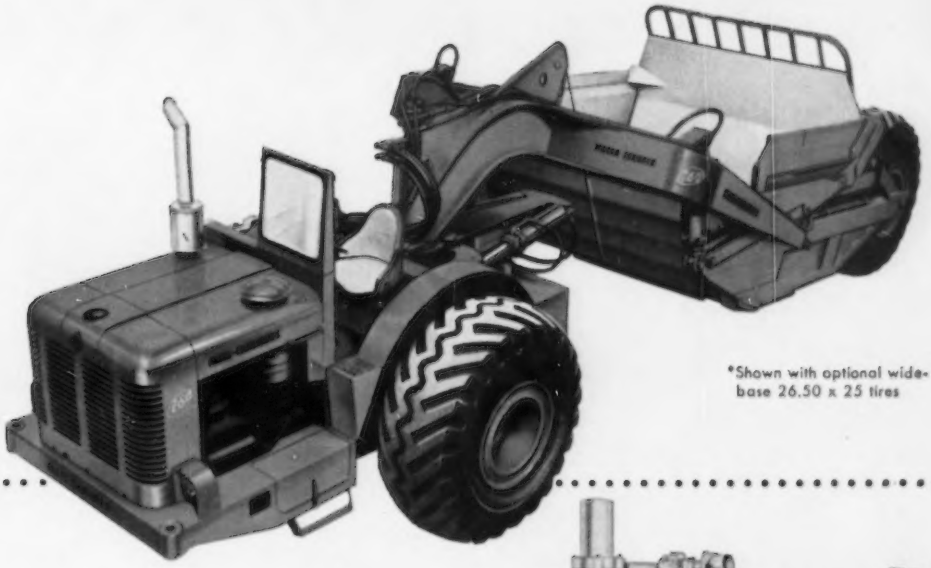
Quick, clean spreading with high apron and forced ejection. Patented linkage moves apron ahead and up when ejector goes forward . . . providing high apron lift and exceptionally large opening for clean, easy-to-control unloading.

Balanced weight distribution for maximum traction, long tire life. When empty, 66 percent of entire TS-260 weight is on front wheels—34 percent on rear wheels. When loaded, each wheel supports equal weight—providing excellent flotation and fast hauling.



Get all the Facts . . . NOW!

See your Allis-Chalmers dealer for full details on the new TS-260. Find out how this new motor scraper is *power-matched* for production and profit on the job.

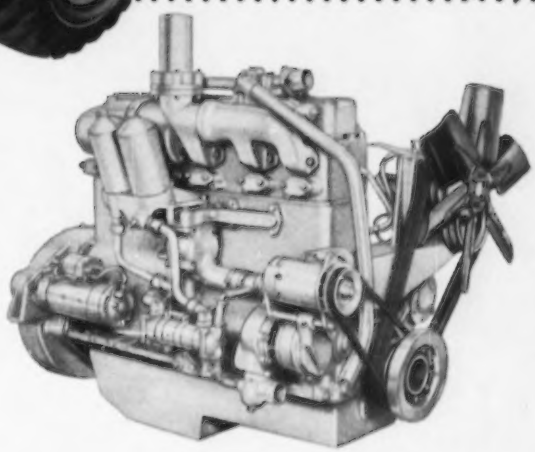


*Shown with optional wide-base 26.50 x 25 tires

Choice of tires to fit job conditions*. Standard 21.00 x 25 (20-ply) or optional wide base 26.50 x 25 (20-ply) tires provide a choice that insures carrying capacity and full flotation for steady going in all types of material.

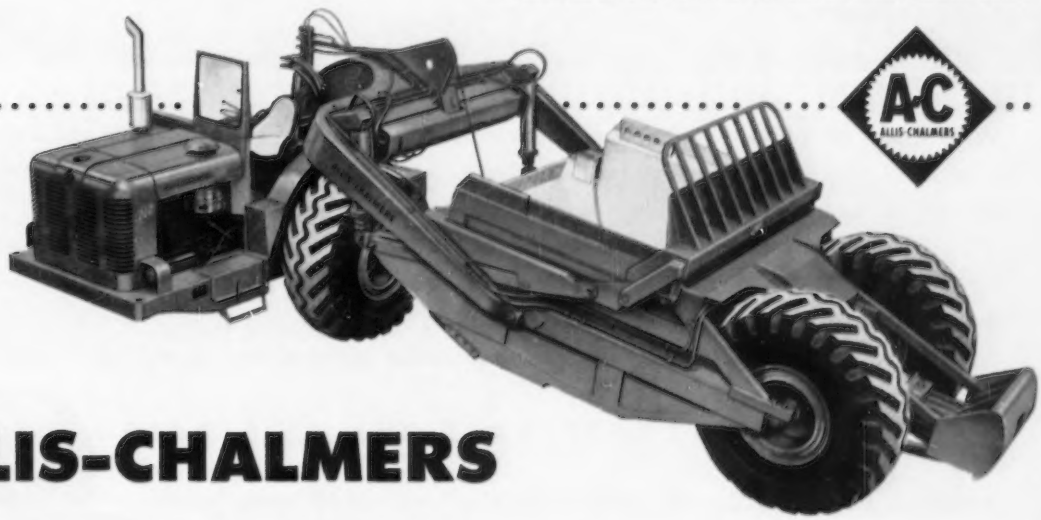
Big 200-horsepower Allis-Chalmers diesel engine. The 844-cubic-inch piston displacement and conservative 200-horsepower rating of this outstanding diesel engine provides plenty of reserve for low-cost operation under all conditions. "Follow-through" combustion results in sustained power, low peak pressures . . . smooth, steady performance.

New easy-shifting transmission. There's a correct gear ratio in the TS-260 transmission for every speed, every work condition. New clutch brake and gear overlap in all four speeds makes it easy to shift gears smoothly, maintain steady acceleration and full pulling power.



Heavy-duty power train. The TS-260 power train is designed to transmit high engine torque to the drive wheels with maximum efficiency. The engine, clutch and constant-mesh transmission are assembled as a unit to assure accurate alignment. Simplified removal of each individual component provides easy serviceability.

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN



A-C ALLIS-CHALMERS

ALLIS-CHALMERS

Wire Rope at Work—This monster, which looks like a cross between a battleship and a dragon, can scoop up 22 yd of earth at a single pull of the bucket. Its insatiable appetite for rock and dirt is its greatest asset, especially in stripping large areas where the overburden is thick.

The huge excavator would get nowhere, of course, without the wire ropes that drag and hoist the bucket. On this job, Bethlehem Purple Strand was used for both applications—2¼-in. 6x25 for the draglines, 1¼-in. 6x41 for the hoist lines. Whopping big cables, particularly the drag ropes; even in the roughest kind of going, they put "hustle" in the job. Ropes like these can move that bucket all day long and still be ready for more.

Bethlehem Steel Company, Bethlehem, Pa. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

Mill depots and distributors from coast to coast stock Bethlehem rope for the following industries and numerous others:

MINING • QUARRYING • CONSTRUCTION • EXCAVATING • PETROLEUM • LOGGING • MANUFACTURING

(Illustration from Agricola's De Re Metallica (1621)

All ore processing was difficult 400 years ago

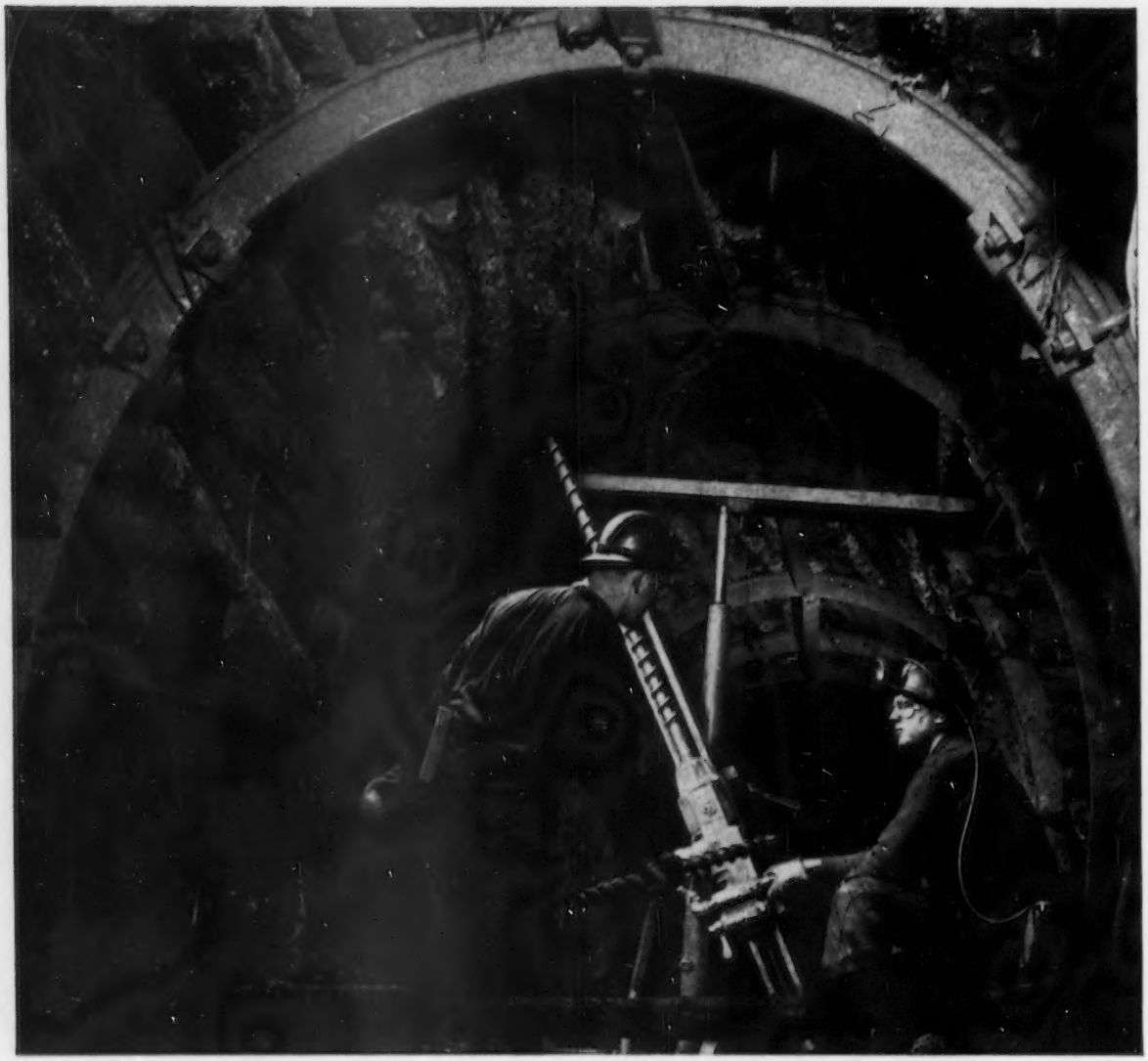
There was a time when the grinding in an ore preparation plant consisted of a man with a hammer—like the one shown here, equipped with heavy leggings and gloves to protect himself against flying ore chips.

Today's ore processing plant is a far cry from this. It utilizes efficient grinding mills that turn out many tons of processed ore every day—mills which so often use CF&I Grinding Balls and Rods. CF&I Grinding Balls and Rods are always made from special analysis steel that has the ideal balance between toughness and hardness to assure optimum grinding ability and maximum wearability.

THE COLORADO FUEL AND IRON CORPORATION

Albuquerque • Amarillo • Billings • Boise • Butte • Casper • Denver • El Paso • Ft. Worth • Houston • Lincoln (Neb)
Los Angeles • Oakland • Oklahoma City • Phoenix • Portland • Pueblo • Salt Lake City • San Antonio
San Francisco • Seattle • Spokane • Wichita

CF&I

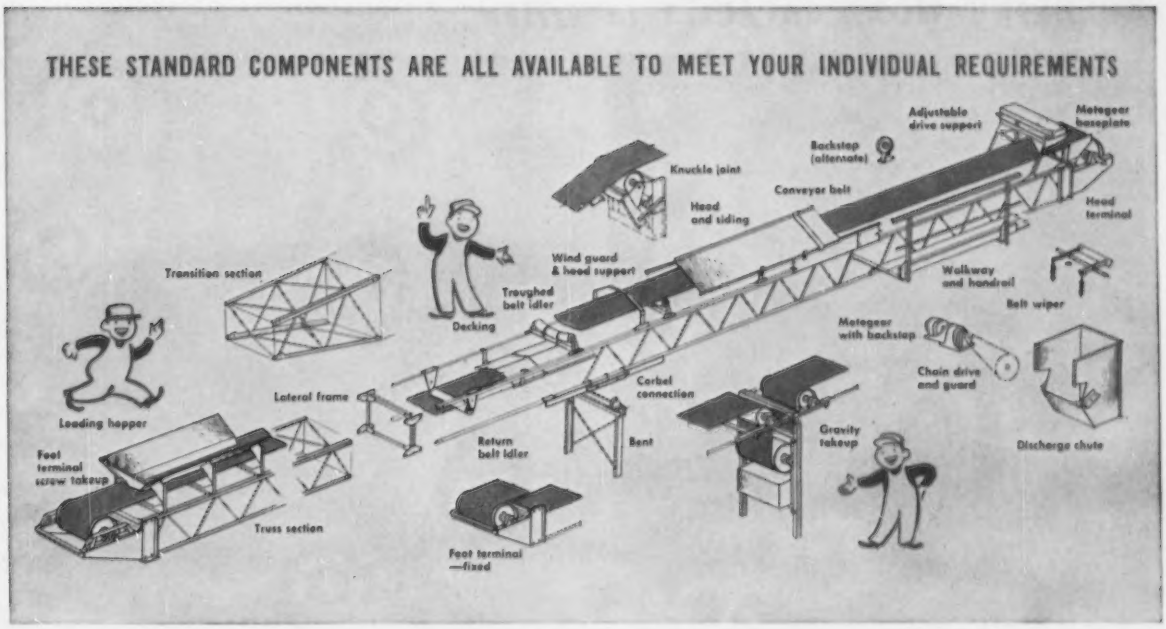


CP ROTAUGER GIVES TWICE THE FOOTAGE ...IN THE SOFTER FORMATIONS!

The CP-555 Rotauger is short in length but long on performance. It combines a fast, powerful rotary drill with an independent rotary motor feed to put the operator in full control at all times. Sets up quickly in tight quarters. Available for dry or wet drilling. Drills up to 3 inch holes more than 100 feet deep at 2 to 4 feet per minute in gypsum, talc, medium limestones and other softer formations. More information is available by writing Chicago Pneumatic Tool Company, 8 East 44th St., New York 17, N. Y.

Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES



NOW! The advantages of engineered belt conveyors in a LINK-BELT

PRE-BILT PACKAGE

Standard 18, 24, 30 and 36-inch widths need no special engineering

Here's an economical, standardized belt conveyor "package" . . . ready to meet the majority of belt conveyor needs and perform dependably for years and years. It combines standard Link-Belt products with sectional truss frames and steel supporting bents.

Book 2579 has further data on Link-Belt PRE-BILT conveyors . . . with drives up to 40 hp and 24 and 42-inch truss depths. Write today, or ask for a copy at your nearest Link-Belt office.

easy selection

Your Link-Belt representative will help you select the best combination of PRE-BILT sectional belt conveyor components.

LINK-BELT

14.114

BELT CONVEYOR EQUIPMENT

prompt quotations

He will prepare a comprehensive and accurate estimate of requirements for installations that permit "on-the-ground" survey.

simplified purchase

Parts are standardized, interchangeable, all available from one supplier. Link-Belt representative can furnish all data.

quick delivery

PRE-BILT conveyors are built at nine strategic locations throughout the country and are shipped from the plant nearest you.

fast installation

Can be readily handled by your own erectors in most cases. Link-Belt can also furnish complete erection service and supervision.

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

KOEHRING WORK CAPACITY *in action . . .*

At a Mid-West quarry, ¾-yard 305 loads out lannon stone. It's another in a new series of Koehring machines, and is similar in basic design to the modern new ½ and 1-yard excavators. Has full complement of standard attachments, on crawlers and rubber (see capacity chart below).

Plenty of pick-up — At an isolated camp in the Sierras, pumps and other machinery had to be unloaded and set in place. The heavy units required careful, precision-handling — and plenty of lift capacity. Above photo shows how they did it with a Koehring 15-ton 205 truck crane.

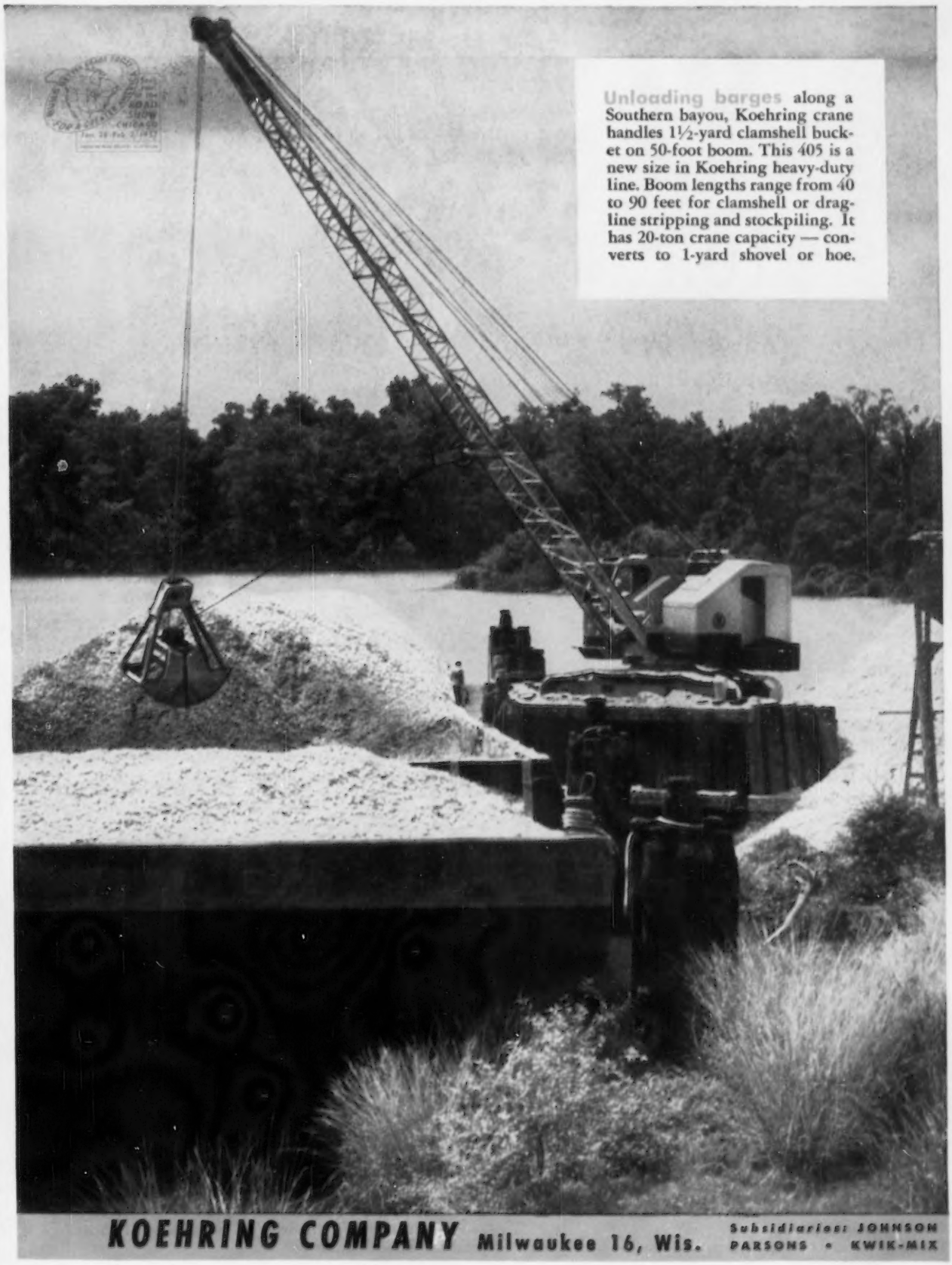
Here are some figures that will interest you:

KOEHRING MODEL	SIZE DIPPER	LIFT CAPACITIES (Crawler ratings based on 75% of tipping load. Rubber-tired machines — 85% of tipping load.)	
205 CRAWLER	½-Yd.	20,000 lbs.	at 10-foot radius
205 ON RUBBER	½-Yd.	30,000 lbs. 13,700 lbs.	at 12-foot radius at 20-foot radius
305 CRAWLER	¾-Yd.	30,000 lbs.	at 12-foot radius
305 ON RUBBER	¾-Yd.	50,000 lbs. 15,800 lbs.	at 10-foot radius at 30-foot radius
405 CRAWLER	1-Yd.	40,000 lbs.	at 12-foot radius
605 CRAWLER	1½-Yds.	72,300 lbs.	at 12-foot radius
1205 CRAWLER	3-Yds.	190,000 lbs.	at 13-foot radius

Want more information? Call Koehring distributor today.

K693

Big producer — Deep stripping uncovered a heavy coal vein at this Eastern mine. Working on mine floor, a Koehring 605 shovel loaded out the coal, and dumped into trucks spotted on upper level. Depending on materials, and type of operation, the 605 can be used with standard 22-ft. shovel boom and 16½-ft. dipper-sticks — or with high-lift 28-ft. boom and 23-ft. dipper-sticks.



Unloading barges along a Southern bayou, Koehring crane handles 1½-yard clamshell bucket on 50-foot boom. This 405 is a new size in Koehring heavy-duty line. Boom lengths range from 40 to 90 feet for clamshell or dragline stripping and stockpiling. It has 20-ton crane capacity — converts to 1-yard shovel or hoe.

KOEHRING COMPANY Milwaukee 16, Wis. Subsidiaries: JOHNSON PARSONS • KWIK-MIX

DOW

XANTHATES: collectors of consistent quality, in pellet form for dustfree handling. Wide range assures high selectivity.

LET THESE Recovery Chemicals

WHEN a mill's sulfide flotation costs are at rock bottom, chances are you'll find Dow Xanthates and Dowfroth® 250 at work in the recovery process. Carefully compounded for independent collecting and frothing, this pair functions in perfect balance to bring you the highest flotation efficiency known.

High selectivity

Dow offers a wide range of Xanthates that are substantially nonfrothing, completely and quickly soluble in water. They are designed for selective flotation to assure maximum loading of the froth as ore conditions change. In addition, these superior collectors assure an unusual ease in handling, for the entire series comes in pellet form. No dust, waste, or spillage problems!

Livelier froth

The ideal working partner to Dow Xanthates—or any other *collector*—is Dowfroth 250. It is completely water-soluble also, and produces a froth that's lively over a wide range of conditions. In many cases, Dowfroth 250 reduces frother consumption as much as 75%! Action is rapid and non-collecting, better accommodates ore variation. And froth is easy to launder, pump and thicken; does not deteriorate rubber parts.

Everyone benefits

Flotation experts agree that Dow Xanthates and Dowfroth 250 do much to improve recovery and concentrate grade. The metallurgist has better control of frother and collector. And the operator's work is pleasanter, thanks to the pellet form of Xanthates and the low volatility of Dowfroth 250. Why not write us for samples today and let every member of your flotation team discover the advantages of these dependable mining chemicals!

DOWFROTH 250 (shown in sample jar): a livelier frother that's noncollecting, easy to regulate. Often cuts consumption 75%!

PROVE THEIR EFFICIENCY TO YOUR WHOLE TEAM

Of course, technical assistance is always available, and oftentimes serves as a short cut in solving problems . . . in finding the answer to increased production per flotation dollar.

We would also be pleased to send a sample of Separan 2610®, the new high-speed flocculant that is doubling—even tripling—production in settling and filtration operations. As little as one pound settles 100 tons of solids! THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. OC 858L.

SEPARAN 2610—Amazing speed of new flocculant is setting economy records throughout the mining industry. One uranium processor, for instance, reports savings of nearly $3000 a day! Faster settling and increased filtration have eliminated four of his five thickeners, two banks of filters, and several earthen ponds.

you can depend on DOW CHEMICALS DOW

LOOKING FOR THE LOWEST-COST TRUCK?

Take a tip from the men who buy trucks every year!

Big fleets buy more Fords

"Our 27 Fords average 5½ miles to the gallon," say cement haulers of Material Transportation Company, Harlington, Texas. "Oil economy is good, too. Our F-800 and F-900 BIG JOBS average 125,000 miles before we drop the pan. Fords are the most economical and satisfactory trucks we've ever used."

The big fleets keep complete cost records. They know which trucks cost less to buy and run. And official R. L. Polk registration figures PROVE FORD IS THE FAVORITE!

Take a look at these pages. These leading companies are just 4 out of thousands that are finding Ford trucks cost less to buy, less to run—*and* are "tops" for all-round economy.

The "men who buy trucks every year" must take everything into consideration . . . Short Stroke engine design for low oil and gas consumption . . . Ford's stronger chassis for longer life (insurance actuaries prove Ford Trucks last longer) . . . and Ford's higher resale value. So—from Pickups to 65,000-lb. GCW BIG JOBS, the big fleets are going Ford. You'll agree *Ford Trucks cost less*—after discussing your needs with your Ford Dealer.

"Our 300 Fords cost less to run," says Johnson, Drake and Piper Inc. of N. Y. City, world-wide contractor and owner of F-800 BIG JOBS. "We've tried all makes but our records show that, when all factors are considered, *Ford Trucks cost less.* Low running costs. Low purchase price. High trade-in value."

than any other make!

"Our 102 Fords last longer," says David L. Brown, Tennessee contractor and owner of Ford T-800 BIG JOBS. "In our kind of work, we need a truck that can take a real beating and keep on going. We have a Ford that's been running for 5½ years without a motor job—and it's still rarin' to go!"

"Our 30 Fords are easiest handling," says Elmer C. Breuer, Cleveland steel hauler. "Maneuvering our Ford F-900's in tight spots is timesaving and easy. And with that Power Steering our drivers finish fresh after a tough day's work. We're staying with Ford because they give us fast, dependable service."

FORD TRUCKS COST LESS—LAST LONGER

Using latest license registration data on 10,502,351 trucks, life insurance experts prove Ford Trucks last Longer.

how to get the most out of HOLLOW DRILL RODS

The present trend in mining is toward smaller drill holes which require the use of smaller bits and, consequently, smaller hollow drill rod sizes. And that's increased the use of *alloy* steels such as Crucible CA DOUBLE DIAMOND and 4E Hollow Drill Rods.

These new alloy rods have proved themselves on many jobs by lengthening rod life, cutting drilling costs. But they are not unmixed blessings, for they will give a good account of themselves only if they are handled properly. Hammer and tongs blacksmithing isn't enough. Alloy rods demand greater care in forging, upsetting and heat-treating.

Should You Use Carbon or Alloy Rods?

There's no one answer to that question, unless it is *use the rod that best fits the individual job.* Generally, air-feed jackhammers and other small, light drills benefit from the use of alloy drill rods. For alloy rods have greater resistance to fatigue, higher elastic limits – important where smaller rod sizes are used.

Rod Stiffness . . .

Rigidity or stiffness can only be increased by enlarging the cross section of the rod. If you decrease the cross section you'll get more whipping no matter what type steel you use, or how you heat treat it. Therefore, don't use a ⅞" hexagon alloy rod when you've been using a 1¼" round carbon rod, unless an increase in flexing and less stiffness is unimportant.

Abrasion Resistance . . .

The higher the hardness the better a drill rod will stand abrasive wear. Alloy rods have the advantage in this respect, for they can be heat-treated to higher hardnesses than can carbon rods.

Notch Effect . . .

Notch effects caused by failure to overlap heats in treating shanks, or those caused by careless handling, chain marks or corrosion pits all cause rod failure. Alloy rods are more resistant to these nicks or notches than carbon steels, but when they do occur failure can be more rapid.

The answer to better drilling is simply this: choose the right drill rod, and then give it reasonable and proper care.

And for the *right* carbon or alloy hollow drill rods – in the sizes, shapes, and grades you need – Crucible is the place to go. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

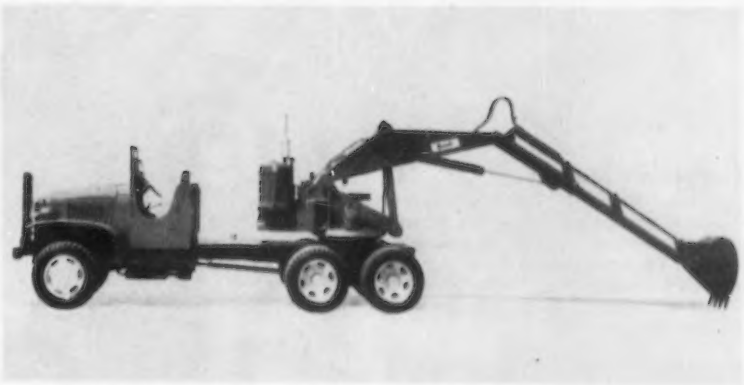
Crucible Steel Company of America

E&MJ NEW PRODUCTS DIGEST

LLOYD E. ANTONIDES, Assistant Editor

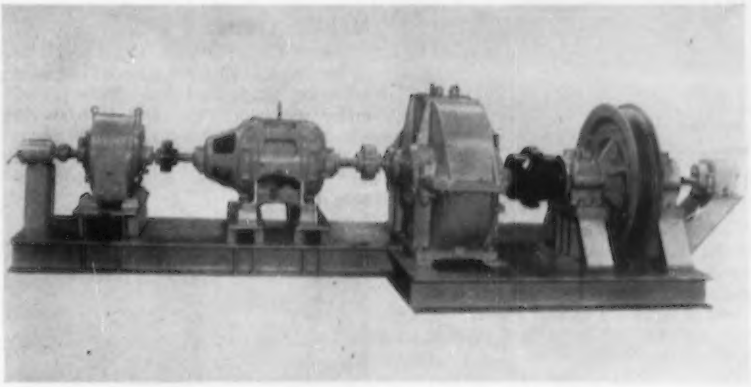
Hydraulic Shovel (1)

Key features of the Yumbo, are a precision built ball bearing turntable and a heavy duty hydraulic system. Turntable consists of lower and upper races, integral gear and center race, and 168 ball bearings. This is said to be the only shovel with a ball bearing turntable having two races of balls working in compression. Attachments for shovel include ¼ yd backhoe, ⅝ yd front dump bucket, ⅜ yd rock bucket, ⅝ yd gravel bucket, ½ yd clamshell. Geco, Inc., Denver, Colo., is maker.



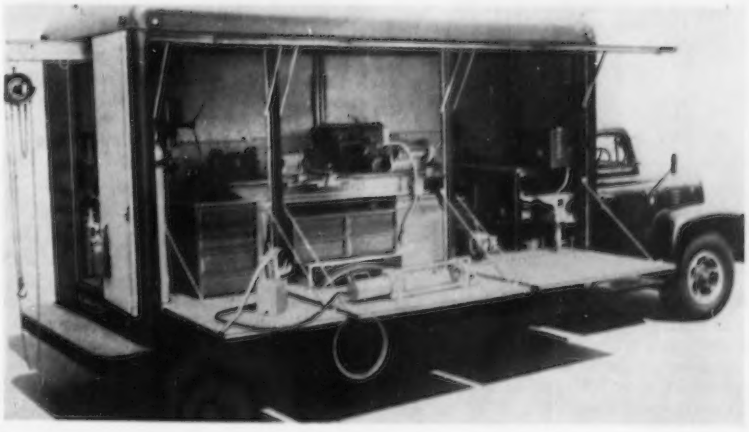
Friction Drive Hoist (2)

Complete friction drive hoist set-up available from Connellsville Mfg. and Mine Supply Co., Connellsville, Pa., includes eddy-current brake, 75 hp Westinghouse wound rotor, three phase, induction motors, thruster brake, motor reducer, main hoist drum and governor. Mounted at top of headframe, it features space-saving compactness. It is component of "packaged" push-button unit offered by company for small shafts.



Mobile Machine Shop (3)

Basic units of this mobile machine shop are Davey air compressors and power and welding generators. These are driven direct from truck engine through power take-off. Numerous accessory tools are available. Shop can be mounted on almost any type of truck. Manufacturer is Davey Compressor Co., Kent, Ohio.

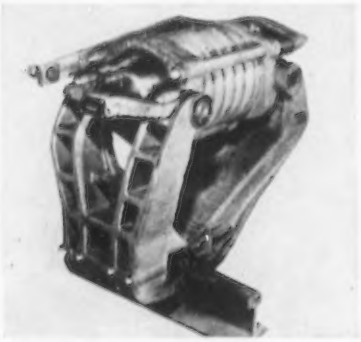


Separation Magnet (4)

Stearns Magnetic, Inc., Milwaukee, Wis., has announced a new line of suspended separation magnets for conveyor systems. Powerful pulling force digs out imbedded tramp iron. Available in a variety of standard sizes or built to individual specifications.

4-Wheel Drive Trucks (5)

For tough cross country hauls, GMC Truck and Coach Division, Pontiac, Mich., has announced a full line of trucks, pickups, panels, station wagon and stake, that can be converted to 4-wheel drive by the flick of a lever. Comes with 130- or 180-hp engines, manual or Hydra-Matic transmissions.



Automatic Rail Clamp (6)

Designed for movable towers and bridges, this self-adjusting, automatic rail clamp uses a spring to supply the clamping force. It is released by a hydraulic cylinder when structure is to be moved. Electrical or hydraulic failure causes clamp to set. Mead-Morrison Div., McKiernan-Terry Corp., Harrison, N. J.

Protective Coating (7)

Rubber coating that can be applied with brush or spray gun is available from Wilbur & Williams Co., Boston, Mass. Called liquid Neoprene, it comes in black, gray, red and aluminum.

Mobile Crane (8)

Hyster Co., Portland, Ore., says that its model KE Karry Krane will readily move any shape load than can be placed under the boom. Capacity is 6,000 lb with single line; 10,000 lb with two-part line. Boom lengths of 9, 10 and 12 ft are available with optional counterweights.

Spray Bandage for Burns (9)

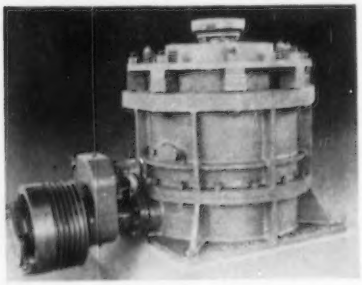
Push-button spray bomb treats burns and protects the skin with a cooling emollient film which isolates the burn, keeps skin soft and moist, and eliminates need for bandages or dressings. General Scientific Equipment Co., Philadelphia, Pa.

Nylon Pipe (10)

About ⅛ the weight of aluminum, nylon pipe is available from Danielson Mfg. Co., Danielson, Conn., in sizes from ⅜ in. O. D. to 1½ in. O. D. Tradenamed, Temper Tube, claims are that it will not soften up to 225 deg. F, will not cold flow, has high tensile strength, withstands high pressures.

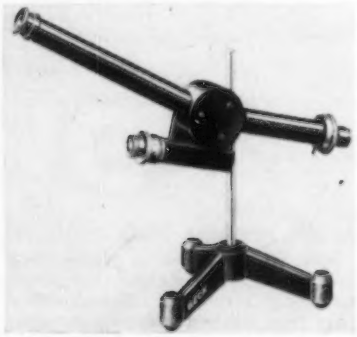
Remote Alarm System (11)

Automatic remote alarm system with both audible and visible warnings for equipment failure or overload, for hazardous conditions or intrusion, is made by Sparton Control Systems Div., Sparks-Withington Co., Jackson, Mich.



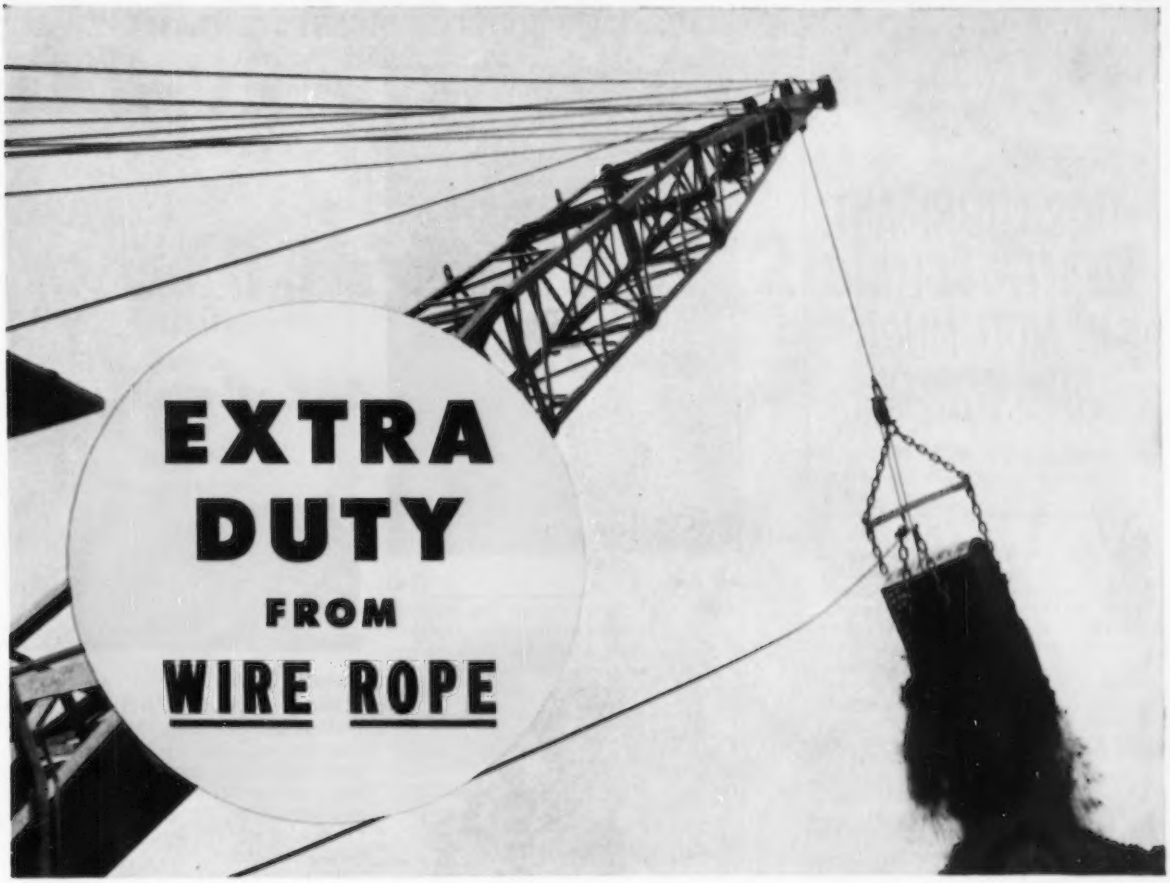
Fine Reduction Crusher (12)

This 28-in. fine reduction gyratory is available with fine, medium and coarse bowl liners. Receiving openings range from 1¾ to 3¾ in. Discharge settings from ¼ to 1¼ in. Capacity from 10 to 75 tph. Low headroom, choke feeding. Straub Mfg. Co., Oakland, Calif.



Spectrometer (13)

Beck Spectrometer No. 3505 reads wavelengths directly in angstroms on a graduated drum to 1A. Aligning the same bands of two readily visible reversed spectra, gives quick, accurate reading. Cost: $260.70. Ealing Corp., Natick, Mass.



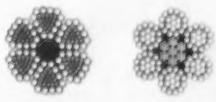
Extra duty — extra hours! That's what users report for Yellow Strand Flattened Strand on mining operations.

Yellow Strand Flattened Strand has strands of triangular shape — distributing the wear over a greater number of wires. This means longer life and less wear on rope and grooves. In addition, it's manufactured to the highest standards of quality by Broderick & Bascom Rope Co.

Take the tip from many satisfied users of Yellow Strand Flattened Strand and specify it on your next order. Take advantage, too, of the prompt service and "on hand stocks" of nearby Yellow Strand Distributors. They're ready to serve you with the right rope when you need it.

COMPARE

Yellow Strand Flattened Strand with Round Strand Wire Rope. In Flattened Strand you have twelve contact points, greater bearing area, smoother surface, less wear. Result: longer service, lower final cost!



Flattened Strand Wire Rope

Round Strand Wire Rope

Yellow Strand®

Manufacturers of Wire Rope for 80 Years

Broderick & Bascom Rope Co.

4203 Union Blvd., St. Louis 15, Mo.

American Logging Tool Corporation is a subsidiary of Broderick & Bascom Rope Co.

"THIS LUBRICANT KEPT 'EM ROLLING IN MUD, MUCK AND WATER"

—says J. O. ARCHIBALD
of Redwood City, California

The job was clearing 500 acres of salt marsh for crystallizing ponds. To quote, "We selected LUBRIPLATE No. 107 for track and general lubrication and LUBRIPLATE APG-140 for transmissions and final drives. During the entire job there was no replacements of track rollers nor any tie-ups of equipment due to parts replacement or breakage!"

REGARDLESS OF THE SIZE AND TYPE OF YOUR MACHINERY, LUBRIPLATE LUBRICANTS WILL IMPROVE ITS OPERATION AND REDUCE MAINTENANCE

LUBRIPLATE LUBRICATION MAKES CARS AND TRUCKS RUN BETTER AND LAST LONGER

LUBRIPLATE H.D.S. MOTOR OIL . . . THE OIL THAT NEEDS NO ADDITIVES

For nearest LUBRIPLATE distributor see Classified Telephone Directory. Send for free "LUBRIPLATE DATA BOOK" . . . a valuable treatise on lubrication. Write LUBRIPLATE DIVISION, Fiske Brothers Refining Co., Newark 5, N. J. or Toledo 5, Ohio.

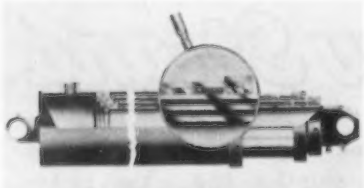
E&MJ NEW PRODUCTS DIGEST *(Continued)*

Air Saw (14)

Just hook into your air line and this saw is ready to go to work. Operates at 70 to 100 psi, using less than 60 cfm at 90 psi. Weighs only 14½ lb, uses twin, interlocked, reciprocating saw blades. Wright Saw Div., Thomas Industries Inc., Louisville, Ky.

Submersible Pump (15)

Built-in check valve, air lock eliminator, controls actuated by air pressure created by liquid level, are among the features of the Model 140, 3,000 gph submersible multi-purpose pump that the Kenco Pump Div. of American Crucible Products Co., Lorain, Ohio, wants you to know about. Offers guaranteed starting with no priming difficulties.

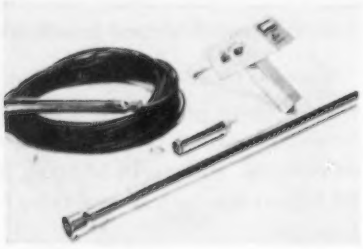


Telescopic Hoist Cylinders (16)

Galion Allsteel Body Co., Galion, Ohio, makes their telescopic hoist cylinders in a wide variety of sizes to meet your needs. Lifting capacities range from 20,000 to 68,000 lb; cylinder diameters from 5 to 8 in., with 3 to 6 stages and 60- to 128-in. stroke lengths.

Rotary Drill (17)

Heavy duty rotary drill for vertical blast holes, Portadrill, Model 6TA, is mounted on diesel prime mover and uses two rotary compressors operating singly or together to remove cuttings. Up to 27,000 lb can be applied to the bit in drilling a 9-in. hole. Circle No. 17 on the postage-free reply card opposite p 42 to get complete specifications from Winter-Weiss Co., Denver, Colo.



Radiation Detection (18)

Compact package for uranium ore evaluation, drill hole surveys, gridmapping and reconnaisance, consists of UAC #411 Geiger Gun, rigid probe and 50-ft drill hole probe, end window for checking faces, core samples. Geiger gun is transistorized, weighs 3 lb. Price: $475. Universal Atomics Corp., New York, N. Y.

Chemical Packing (19)

Fine pure Teflon fibers braided over a core of glass fibers and impregnated with Teflon yields a soft, pliable, low friction packing for centrifugal as well as reciprocating and static applications. It is said to give good performance under widely varying conditions of temperature and chemical exposure. Abbott & Biddle, Philadelphia, Pa.

To celebrate its first birthday

THE D9 GETS INCREASED HP

—more power for your operation!

320 HP
(FLYWHEEL)

formerly 286 HP

260 HP
(DRAWBAR)

formerly 230 HP

The giant Turbocharged CAT* D9 Tractor, which since its introduction last year has set new performance standards in the field, now packs more power than ever to handle even bigger jobs. Its drawbar capacity has been increased from 230 HP to 260 HP—its flywheel horsepower from 286 to 320!

This increase in power reflects Caterpillar's policy of leadership in action. Combining research with practical field experience, there's constant product improvement to meet your needs for bigger production at lower cost. This policy applies to *every* product in the Caterpillar line—Diesel Engines, Tractors, Motor Graders and Earthmoving Equipment.

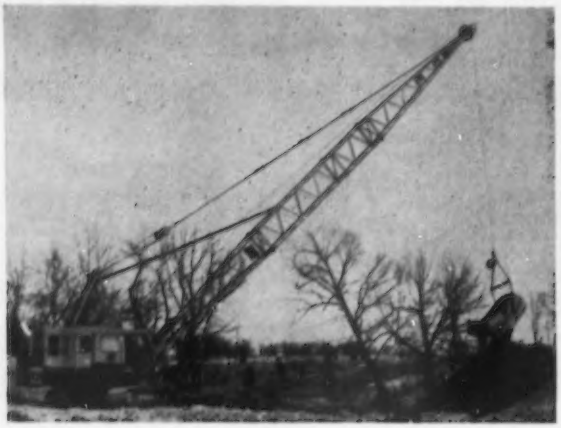
Now, with its increased horsepower, you can give the D9 tougher jobs than ever before. To match your requirements, it's available with torque converter or direct drive with oil clutch. For complete details about the more powerful D9, see your Caterpillar Dealer. Name the date—he'll be glad to demonstrate!

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

CATERPILLAR*

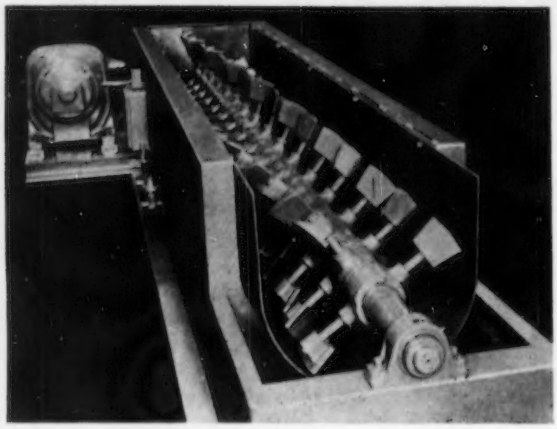
*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

D9—MORE POWERFUL FOR BIGGER PRODUCTION



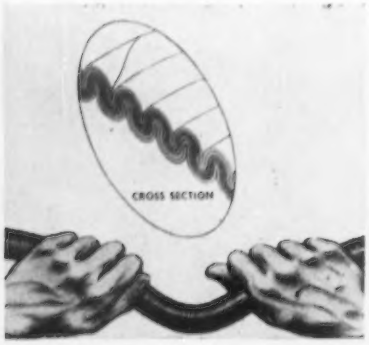
Excavator **(20)**

Excavator Model 1205, is latest and largest in line of cranes and shovels manufactured by Koehring Co., Milwaukee, Wis. Capacity is 3 cu yd; lifting capacity is 95 tons at 75% rating. Easily convertible for other applications.



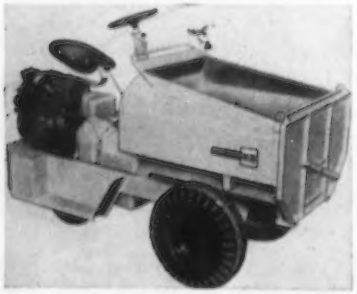
Continuous Mixing Machine **(21)**

Continuous mixing machine is designed for handling 20 to 30 cu yd per hour, dry to soupy mix. Uses 10-hp gearhead motor with chain drive. Paddles are adjustable radially and angularly. Gas Machinery Co.



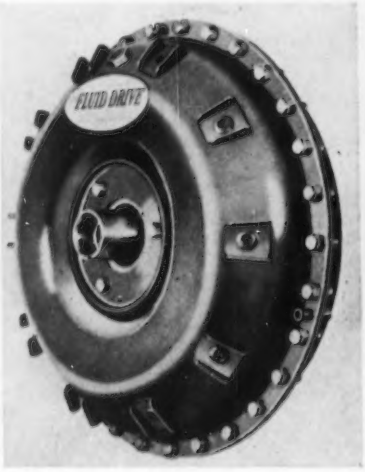
Bendable Tubing **(22)**

Meet Plica, the bendable tubing that can be cut with a hacksaw or knife, bent by hand to stay bent, and fits all standard connectors. Has three-ply wall and can be made in almost any combination of ferrous and non-ferrous metals, fiber paper, etc., in ⅜ to 2-in. ID. Flexaust Co., Amesbury, Mass.



Materials Handling Truck **(23)**

First truck of its type to use a torque converter, is the claim made for this 1½-ton industrial truck, by Prime-Mover Co., Muscatine, Ia. Top speed is 12 mph with the 15-hp air cooled engine and automotive type drive shaft.

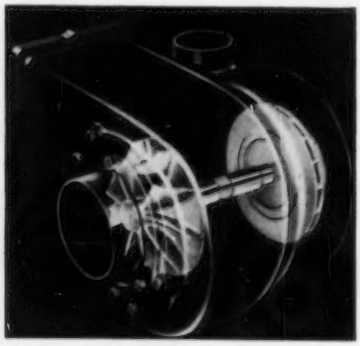


Fluid Drive **(24)**

Fluid power transmission, designed for mobile material handling units using internal combustion engines, has power rating of 25 to 85 hp, depending on drive speed. When modified by flexible coupling half on each end of fluid drive, unit can be used for constant speed electric motor applications. American Blower Corp., Detroit, Mich.

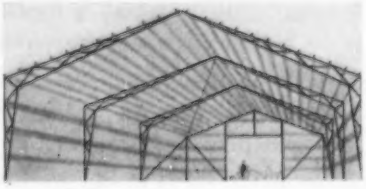
Graphite Gun **(25)**

Blaco graphite gun may do for graphite what the aerosol bomb did for insecticides. It's small enough to hold in the hand and sprays dry lubricant at its target while held in any position. Contains enough for several thousand shots. Servwell Products Co., Cleveland, Ohio.



Turbodiesel Engine **(26)**

Extensively field tested, a 335-hp turbodiesel engine, designated NRTO-6, is now available from Cummins Engine Co., Inc., Columbus, Ind. Cummins engineers say that the high output of the unit is made possible by the use of the exclusive exhaust gas turbocharger shown above. Compared to a naturally aspirated engine of the same displacement, the NRTO-6 is said to develop 67½% more power.



Easy Building **(27)**

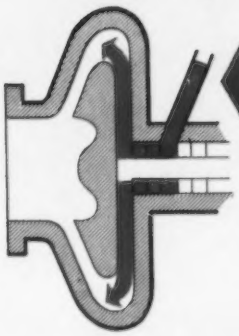
Steel frames with tapering depth and lattice framework are capable of supporting 10,000 lb over each a 40-ft span. No skilled construction workers or expensive scaffolding are needed. Pruden Product Co., Evansville, Wis.

For More Information

Use Reply Card Opp p 42

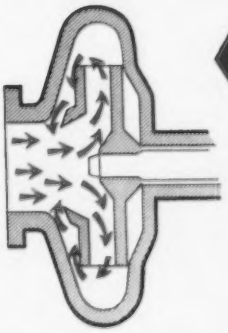
VACSEAL PUMP

designed to meet rigid requirements in pumping abrasives and corrosives.



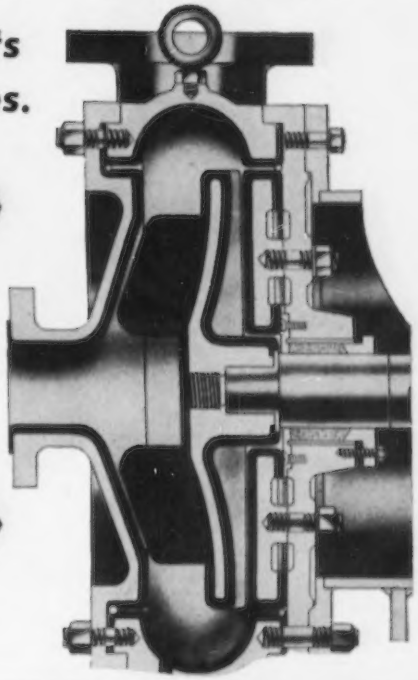
Elimination of sealing water

When dilution of material is an objectionable or prohibitive factor in pumping operations, VACSEAL is the answer to the problem. Vacuum seal is accomplished by a unique (patented) impeller — with pumping blades on one side and large diameter auxiliary vanes on the reverse side that produce a partial vacuum on the shaft and packing. The result is virtually a glandless pump that requires no sealing water to prevent shaft wear and leakage. This VACSEAL feature eliminates cost of plumbing, storage tank and pump to handle fresh water supply.



Closed vs open impeller

The modern trend in handling solids is toward the use of open impellers. Thus, there is no surface to be sealed between impeller and suction cover. This eliminates undesirable "double-pumping" that often results from wear caused by the handling of abrasives. This safeguard assures longer pump life with a minimum of maintenance and without reduction in capacity.



Suction lift

VACSEAL Pumps are capable of suction lifts up to 20" Hg. Because of this suction capability, there is less tendency to air-lock or cease pumping should the intake line become partially obstructed. This feature allows the VACSEAL to be used successfully as a dredge pump or a sump pump.

Chart at right compares these features with six other brands of pumps. Only VACSEAL has all three. Write for FREE bulletin PB-55.

	NO SEALING WATER	SEMI OPEN IMPELLER	CAPABLE OF SUCTION
VACSEAL	✓	✓	✓
PUMP A	✓		
PUMP B			✓
PUMP C	✓		✓
PUMP D		✓	✓
PUMP E		✓	✓
PUMP F	✓		✓

VACSEAL Pumps incorporate design features that have been proven successfully for 19 years. VACSEAL is available with fixed or replaceable rubber liners or all alloy and in a range of sizes from 1½"x2" through 8"x10".

GALIGHER PRODUCTS
Commercial and Laboratory AGITAIR®
VACSEAL Pump
Vertical VACSEAL Pump
Acid-Proof Sump Pumps
Laboratory Ball Mills
Geary-Jennings Sampler
Geary Reagent Feeder
Laboratory Pressure Filters

Leaders in Experience & Service

THE GALIGHER CO.

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PLANT DESIGN

Home Office: P. O. Box 209 Salt Lake City 10, Utah
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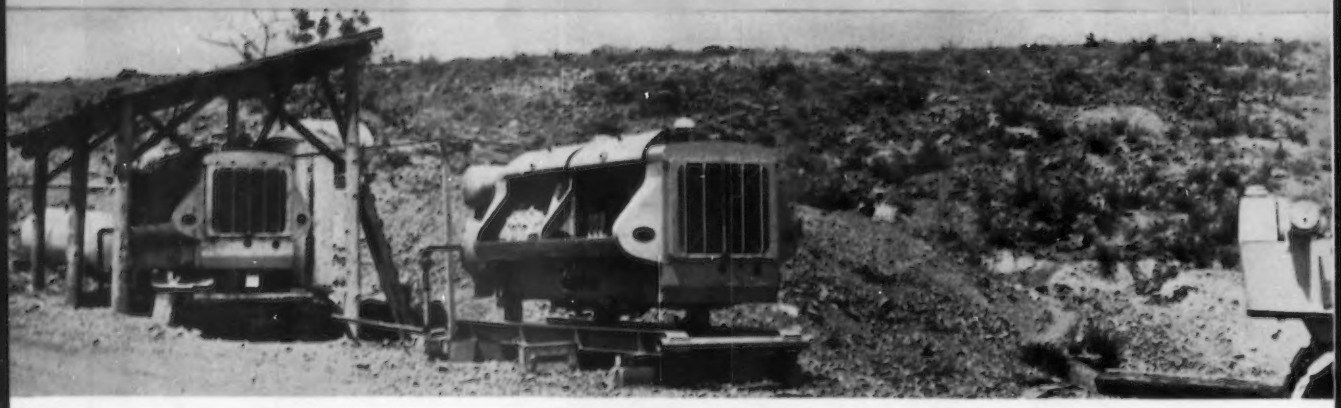
AT THIS FAMOUS MINING SITE—
"PLENTY OF RELIABLE POWER"



This is the site of the "Bridal Chamber," where a solid chunk of nearly pure silver weighing an estimated six million ounces was discovered in the late nineteenth century. There is now a manganese mine and mill on the site at Lake Valley, New Mexico.

Two Caterpillar D13000s run 16 hours a day, providing all pneumatic power through Gardner-Denver compressors. The CAT* Diesels have needed no repairs. A third Cat, a D13000 Electric Set, supplies electric power for the manganese mill.

"Our three Caterpillar D13000 Engines supply our mining and milling operations with plenty of reliable power," says the mill superintendent for Haile Mines, Inc., of Hillsboro, N. M.

Now you can get the new Caterpillar D342, which replaces the D13000 in the Caterpillar line. Capable of 210 HP (maximum output capacity), the four-cycle D342 Diesel is built to do more work at lower cost with less down time than any other engine in its class. Like all other Caterpillar Engines, the D342 has such long-life features as "Hi-Electro" hardened crankshaft journals and cylinder liners, foul-free fuel injection, aluminum alloy bearings, and highly effective filters and seals to protect its built-in Caterpillar precision.

There is a full line of Caterpillar Diesels, up to 650 HP (maximum output capacity). Your Caterpillar Dealer will help you select the Cat Engine or Electric Set that's "tailor made" to do most work for you at lowest cost. Ask him for full facts and figures soon. And count on him whenever you need skilled service and parts you can trust.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

MODERN
HEAVY-DUTY POWER

For Your Files

This informative manufacturers' literature is free unless otherwise specified. To obtain bulletins circle their numbers on card at right and mail.

HARDFACING WELDING is subject treated in "Fusion Facts" a quarterly periodical issued by Stoody Co., Whittier, Calif. Spring 1956 number is full of mining applications. **(51)**

PIPING SYSTEMS are covered in periodical titled "The Valve World" published by Crane Co., Chicago, Ill. An excellent article on Establishing Welding Procedures and Qualifying Welder is given in No. 1, 1956. **(52)**

INDUSTRIAL FILTRATION and porous media, as well as brief-clad beauties, are topics included in "Poroscope," an informative folder issued periodically by the Pall Filtration Companies, Glen Cove, N. Y. **(53)**

ENGINEERING DEVELOPMENTS of Allis-Chalmers' Industries Group during 1955 are reviewed in annual booklet recently issued. Their accomplishments in the mineral industries are worth knowing. Just scanning the booklet leaves one amazed at the breadth of interest and facilities available. **(54)**

FLOTATION INDEX covering articles which appeared in 1955, is 26th annual supplement issued by Dow Chemical Co., Midland, Mich. Other selected ore dressing articles are also indexed. **(55)**

DEAERATION—Why? How? is folder from Cochrane Corp., Philadelphia, Pa., which explains fundamentals in capsule form. **(56)**

SPECTROCHEMICAL ANALYSIS is concisely described in attractive full color brochure suitable for framing. Each step in process is shown. National Spectrographic Laboratories Inc., Cleveland, Ohio, offers it. **(57)**

V-BELT Trouble Savers #2 and #3, part of five, are now available from Worthington Corp., Harrison, N. J. Cartoons illustrate the tips on suitable-for-wall-mounting folders. **(58)**

DIESEL ENGINE questions are answered in a 24-page booklet offered by Cummins Engine Co., Inc., Columbus, Ind. It is a well illustrated and meaty text that really covers the whole subject. **(59)**

FLOOR GRATING & ARMOR is treated in hardback technical manual from Klemp Metal Grating Corp., Chicago, Ill. The 12-page publication is complete yet concise. **(60)**

TUNGSTEN CARBIDE MINING TOOLS for cutters and rotary drills are shown in revised edition of catalog from Allegheny Ludlum Steel Corp., Pittsburgh, Pa. Sharpening procedures are described. **(61)**

HOSE ACCESSORIES & FITTINGS, Le-Hi brand, available from Hose Accessories Co., Philadelphia, Pa., are described and illustrated in condensed catalog No. 18. Air hose fittings are enlarged upon in Bull. 110. **(62 & 63)**

DRY PROCESSING EQUIPMENT is subject of 8-page booklet offered by Sturtevant Mill Co., Boston, Mass. One feature of the company's equipment is that all are designed for "one-man, one minute" accessibility to all vital parts. **(64)**

WOVEN WIRE SCREENS available from Simplicity Engineering Co., Durand, Mich., are described in bulletin. Complete line for repair and replacement is covered. **(65)**

MECHANICAL POWER TRANSMISSION products offered by Dodge Mfg. Corp., Mishawaka, Ind., are cataloged in comprehensive 328-page publication. **(66)**

ROLLER CHAIN and accessories for drives and conveyors are thoroughly described in 148-page book by Link-Belt Co., Chicago, Ill. Profusely illustrated it is said to embrace one of the most complete lines of roller chains. **(67)**

SOLENOID VALVES made by Automatic Switch Co., Orange, N. J., are cataloged in manual recently issued. Selection and basic design data are included. Two-, three- and four-way valves are available to fit almost any situation. **(68)**

Mn-Ni STEEL WELDING PRODUCTS offered by Taylor-Wharton Div., Harsco Corp., High Bridge, N. J., are specified as to size and price as well as application, in four-page folder. Wedge bars, tooth repointers, electrodes and shapes are given. **(69)**

LUBRICANTS, branded Lubriplate, both grease and fluid types, are claimed to have exceptional adhesive qualities lending themselves to severe conditions. Publication just issued by Fiske Bros. Refining Co., Newark, N. J., describes the products, gives

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8	22	36	50	64	78	92
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14	28	42	56	70	84	98

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E&MJ NEW PRODUCTS DIGEST *(Continued)*

index list of applications and tells where they are sold. **(70)**

ELECTRIC GENERATING PLANTS available from D. W. Onan & Sons, Inc., Minneapolis, Minn., are cataloged in bulletin. Complete line of portable, mobile and stationary units is concisely presented. **(71)**

FLASHING SAFETY LIGHTS are described in 4-page bulletin from R. D. Fageol Co., Kent, Ohio. Self-contained battery units use little electricity. **(72)**

FIRST AID KITS offered by E. D. Bullard Co., San Francisco, Calif., come in over 100 styles to fit various specifications. Catalog describes them. One feature is use of polyethylene bottles for all liquids. **(73)**

DRAFTING AID called Chart-Pak method, consists of sensitive tapes and sheets of color, cross-hatch patterns, flow sheet symbols, arrows, numbers, et al. Catalog offered by Chart-Pak Inc., Stamford, Conn., is "Visualization Made Easier." **(74)**

CONE CRUSHERS trademarked Symons and made by Nordberg Mfg. Co., Milwaukee, Wis., are described in detail in bulletin just published. Both standard and short head types are covered. **(75)**

SETTLING UNITS for removing solids from water, called Rex Verti-Flow, come as packaged steel tank or for concrete basins. Literature is available from Chain Belt Co., Milwaukee, Wis. **(76)**

WATER FILTERS, pressure type, from Graver Water Conditioning Co., New York, N. Y., are described in recent bulletin. Horizontal and vertical units are shown as well as accessories. **(77)**

VIBRATORY FEEDERS & BIN VIBRATORS utilizing electro-permanent magnetic devices are described in brochure from Eriez Mfg. Co., Erie, Pa. Hi-Vi design needs no rectifier and has no rotating or sliding parts. **(78)**

HEAD PULLEYS for belt conveyors or bucket elevators made by Yuba Mfg. Co., Benicia, Calif., have motor inside. Trademarked Yuba - Schrock, units are compact and simple in design. Folder gives specifications, and features. **(79)**

STEEL MESH CONVEYOR BELTS from Colorado Fuel and Iron Corp., New York, N. Y., have special features beyond durability and strength. Description and selection data are presented in 16-page booklet. **(80)**

FLEXIBLE IDLERS for belt conveyors called Limberoller, consist of rubber discs suspended on wire rope. Design and application data is given in bulletin from Joy Mfg. Co., Pittsburgh, Pa. **(81)**

PINCH VALVES of Equipment Engineers Inc., San Francisco, Calif., have rubber section in which orifice always remains circular for low pressure drop. In this Krebs design for heavy duty, hydraulic pressure is used for closure. Folder on them is offered. **(82)**

VALVES by Golden Anderson Valve Specialty Co., Pittsburgh, Pa., use line pressure to furnish power to open or close. Push button units come in many sizes and styles. Bulletin describes them. **(83)**

ELECTRIC MOTORS of explosion-proof design are treated in publication from General Electric Co., Schenectady, N. Y. Trademark of one to 30 hp units is Tri-Clad 55. **(84)**

ELECTRIC CABLE SPLICING using resin is recommended for best protection against electrical breakdown and moisture. Scotchcast system is neat and simple. Bulletin is available from Minnesota Mining and Mfg. Co., St. Paul, Minn. **(85)**

CENTRALIZED LUBRICATION SYSTEMS are offered by Dravo Corp., Pittsburgh, Pa., under trademark of Dravo-DeLaval. Both packaged and custom designed units are available. Folder gives brief description. **(86)**

FEED CONTROL for grinding mill called Electric Ear is electronic sound sensitive device offered by Hardinge Co., Inc., York, Pa. 8-page bulletin gives complete details. **(87)**

ELEVATOR called Manlift takes less space than stairs and is fast means of interfloor transportation. It can be used to lift packaged material as well. Allis-Chalmers Mfg. Co., Milwaukee, Wis., has bulletin on it. **(88)**

INERT GAS GENERATORS are coming into wider use for protection against fire and explosion in many industrial plants. Roots-Connersville Blower, Connersville, Ind., has descriptive bulletin on theirs'. **(89)**

ULTRASONIC GENERATOR claimed as a low cost power supply that breaks the barrier to wide use of ultrasonics in cleaning, drilling and grinding in fabricating shops and plants, is described in booklet from Acoustica Associates Inc. Glenwood Landing, N. Y. **(90)**

DOCKS, wharves and piers using prefabricated members, the DeLong jack and columnar steel caisson supports are described in booklet by DeLong Corp., New York, N. Y. For permanent or temporary installations around the world, the technique is shown to be highly versatile and economic. **(91)**

WIRE ROPE service record stickers similar to the familiar auto lube sticker, are basis of system announced by Leschen Wire Rope, St. Louis, Mo., for increasing efficiency and cutting maintenance costs of wire rope. Sticker is attached to prominent place on equipment of which rope is component. **(92)**

(PLEASE GIVE THIS ADVERTISEMENT TO YOUR BLASTING FOREMAN)

IGNITACORD will ignite every fuse in the round

while your Blaster is far, far away!

With Ignitacord* you can have controlled rotation spitting of safety fuse in a round. Here are some of the advantages for you:

Less Hazard. The Blaster lights the Ignitacord at one point. This point can be at the face, if the path of retreat is clear; or at a remote point if the path is difficult, such as when shooting a raise.

Easy Figuring. All fuses in the round are cut to uniform length. There is no need for trimming, since accurate time delay is governed by the length of Ignitacord between holes.

*Sold on the West Coast under the name of SPITTERCORD by the Coast Manufacturing and Supply Co., Livermore, California.

Fig. 1 **FIRING STOPE ROUNDS**

Fig. 1 shows a stope drilled with three rows of uppers, the fuse from each hole being connected to a single line of Ignitacord. Note that the center holes will fire before the two corresponding rib holes.

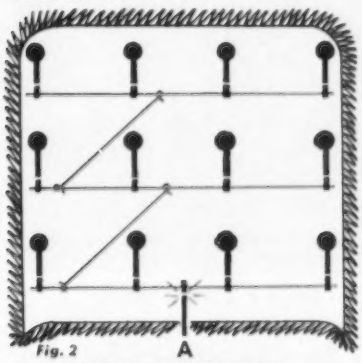


Fig. 2 **FIRING STOPE ROUNDS**

In *Fig. 2* the fuses extending from the horizontal breast holes are connected to four lines of Ignitacord at regularly spaced intervals. Jumper lines connect the horizontal lines, and the Igniter cord is activated by a length of Safety Fuse at Point A.

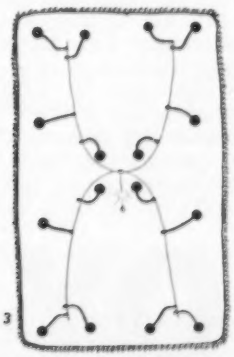
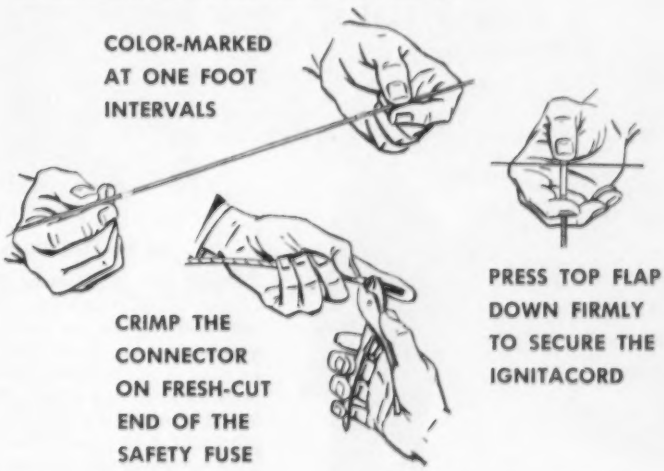


Fig. 3 **FIRING DEVELOPMENT ROUNDS**

Fig. 3 illustrates an Ignitacord hook-up arranged to fire the cut holes in one group, and the remaining holes in the proper order of rotation. Ignitacord lines should always be kept separated enough to avoid cross ignition.


COLOR-MARKED AT ONE FOOT INTERVALS
CRIMP THE CONNECTOR ON FRESH-CUT END OF THE SAFETY FUSE
PRESS TOP FLAP DOWN FIRMLY TO SECURE THE IGNITACORD

Ignitacord burns progressively with a short hot external flame at the zone of burning. Two types are available. Type A burns at the rate of 8 to 10 seconds per foot. Type B burns at the rate of 16 to 20 seconds per foot. Each type is packed on 100-ft. spools.

Ignitacord Connector is a metal shell containing an ignition charge. The shell is crimped on the end of the fuse. Ignitacord is pressed into a slot near the top, and this top is pressed down firmly against it. Connectors are supplied in packages of 100.

See your Explosives Supplier or write to

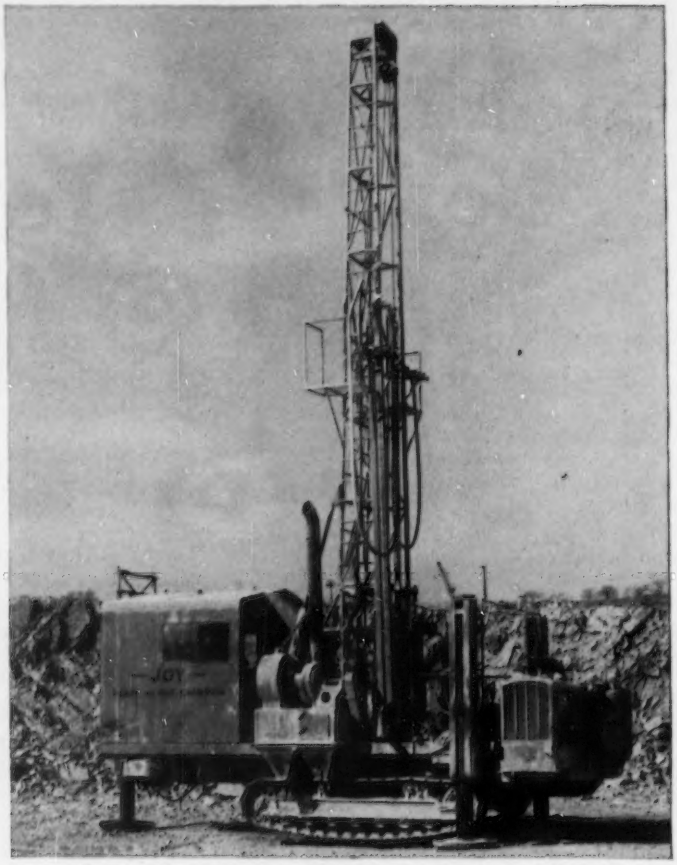
THE ENSIGN-BICKFORD COMPANY

SIMSBURY, CONNECTICUT

Manufacturers of Primacord® Detonating Fuse, Safety Fuse, Quarrycord, Blasting Accessories — Established 1836

IG-2

"...this JOY CHAMPION BLAST HOLE DRILL was so good We Bought TWO More"



"IT OUTDRILLS SEVEN CHURN DRILLS"
at the G. & W. H. Corson Quarry, Plymouth Meeting, Pa.

CHARLES LAUMAN
CONTRACT BLAST HOLE DRILLER
NORRISTOWN, PA.

"That's not all," states Contract Driller Charles Lauman. "Most of our drilling is in hard, tough dolomite with strata tilted at all angles and loaded with clay pockets and clay seams. We have found that the 58-BH Joy Champion will drill a smoother vertical hole wherever the hole is spotted. This eliminates toes and gives our customers a straight vertical face. We're convinced it's the best machine for the job—so much so that we bought two more on the strength of this one's production."

The Joy Champion DRILLS DRY with a tri-cone roller bit which continuously pressure-cuts the rock. An air-blast, forced down the drill pipe and through the bit, cools the bit and forces cuttings to the surface.

The Champion drills straight, smooth-walled, easily loaded holes up to 7⅞" diameter and to any quarrying depth required. It moves fast between holes and sets up quickly for drilling on three hydraulic jacks. Two Champion models—Mediumweight and Heavyweight—can be furnished with either electric or diesel drive. ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

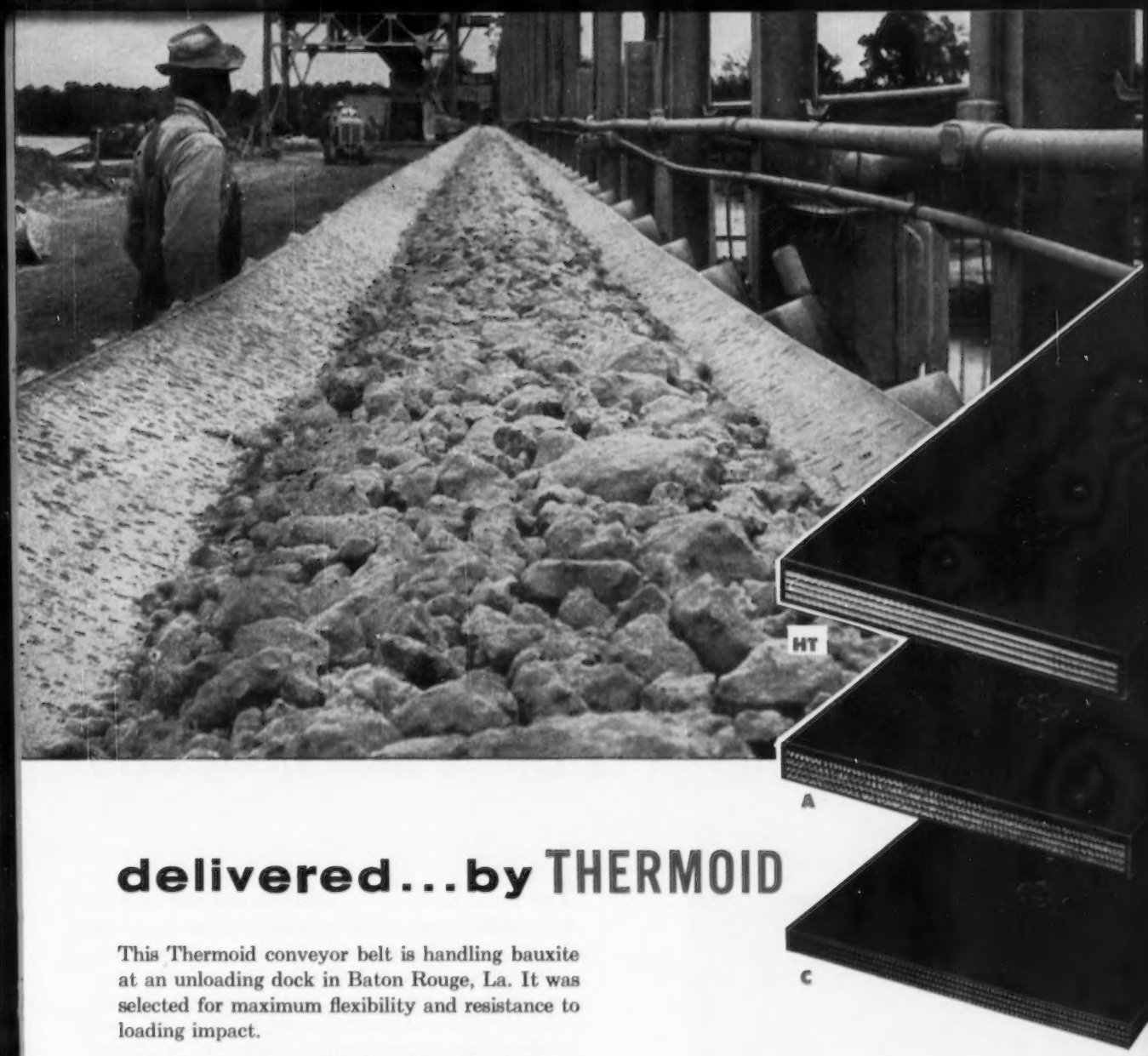
Consult a Joy Engineer

OR **Write for FREE Bulletin 115-4**

WBW RG274-115

JOY

PIONEER AND WORLD'S LARGEST MANUFACTURER OF ROTARY BLAST HOLE DRILLS



delivered...by THERMOID

This Thermoid conveyor belt is handling bauxite at an unloading dock in Baton Rouge, La. It was selected for maximum flexibility and resistance to loading impact.

Whatever your materials handling job, there are Thermoid conveyor belts designed to meet your requirements. For example: Thermoid HT for extremely abrasive materials such as quartz ores, trap rock and coal . . . Thermoid A for highly abrasive materials: slag, lime rock, ore, ashes, hot cement and crushed stone . . . Thermoid C for moderate abrasives such as sand, loam and gravel.

Put belts like these to work on your conveyors. Get the long wearing advantages of Thermoid's exclusive impregnation process. It welds belt carcass and cover into a real brute for punishment! Thermoid's specially woven, finest quality reinforcement troughs easily—withstands shock loading like no ordinary belt can do.

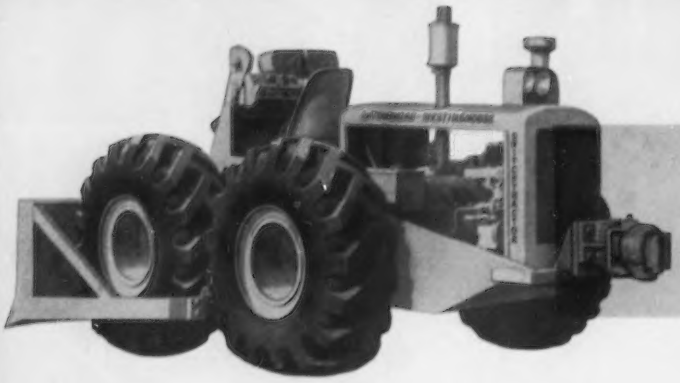
Your Thermoid Distributor will be glad to help you select the conveyor belt that's right for your needs.

Thermoid makes many types of hose designed for specific mining applications. Quality construction saves hose dollars.

Maximum efficiency in power transmission is assured with long wearing matched sets of Thermoid Multi-V Belts.

Thermoid

THERMOID COMPANY, Trenton, N.J.



new switch for old rig!

SwitchTractor

Now . . . time-tested Tournatractor

When not needed for spotting or hauling rail-cars, fast-moving, double-duty SwitchTractor drives anywhere around pit or plant on dozing, maintenance, and clean-up chores.

Ten years' hard use has improved and perfected the fast, rubber-tired performance of this work-and-run Tournatractor. Thousands of these machines have proved their value in dozing, hauling, pushing, grading, scarifying, compacting, and snowplowing in practically every country of the world. Each year has seen many major improvements. Wherever speed and maneuverability are needed, these fast-moving rigs have given outstanding service.

Doubles value of Tournatractor

Now — with new *SwitchTractor* application — this versatile unit gives you added utility. Equipped with a standard railway coupler at the rear, SwitchTractor does double-duty on your location . . . switches freight cars on your siding, yard, or pit at a moment's notice. Rig has plenty of power and traction to pull and spot long trains of cars as needed, saving time and money.

SwitchTractor often eliminates the need for maintaining private switch engines and engineers . . . saves charges and delays for RR switch service. Your single SwitchTractor and operator may well handle all your scattered tractor-dozer work — plus whatever freight-

New double-duty SwitchTractor
Famous high-speed work-and-run tractor now available with standard railroad coupling attachment. Makes rig even more versatile . . . gives you the plus value of a go-anywhere off-track switcher for hauling and spotting cars on your sidings, yard, or pit.

also spots and switches freight cars

car switching is required! Highly maneuverable in close quarters, unit turns around in its own length.

Off-track travel cuts switching time

SwitchTractor gives you several important advantages. Rolling on big, low-pressure rubber tires, this go-anywhere rig always takes the shortest route to every switching or hauling assignment. No matter where it happens to be working, unit easily highballs across yards, fields, tracks, ties, ditches, embankments to its next assignment — without damage to machine or roadbed. In hauling cars, it straddles tracks . . . does not chamfer ties or damage switches.

Depending on the distance and number of cars to be spotted or hauled, SwitchTractor can either push (with its dozer or push-plate), or pull with its drawbar. Coupling to cars with drawbar at rear takes but a moment. Coupler is safe, sturdy, standard RR type.

60% vs 30% coefficient of friction

Rolling on big rubber tires over ballast and ties, instead of with steel wheels on steel rails, SwitchTractor develops much more coefficient of friction (60% compared to 30%) than track locomotives of *twice* its weight. That means you have plenty of tractive power for fast starts and stiff rail grades in hauling cars. When not needed for handling cars on your pit or yard tracks, SwitchTractor keeps working productively for you as a dozer or towing tractor.

Worthwhile savings with SwitchTractor

If you have freight cars to move on your siding, yard, or pit, the added versatility of this new SwitchTractor will really pay off for you. Get all the facts on how this coupling-equipped go-anywhere tractor can save thousands of dollars for you in equipment investments and manpower economies. Phone or write us for details and a demonstration in handling *your* type of work.

SwitchTractor—Trademark, Tournatractor—Trademark Reg. U.S. Pat. Off. ST-1075-M

LeTourneau-WESTINGHOUSE Company
Peoria, Illinois
A Subsidiary of Westinghouse Air Brake Company

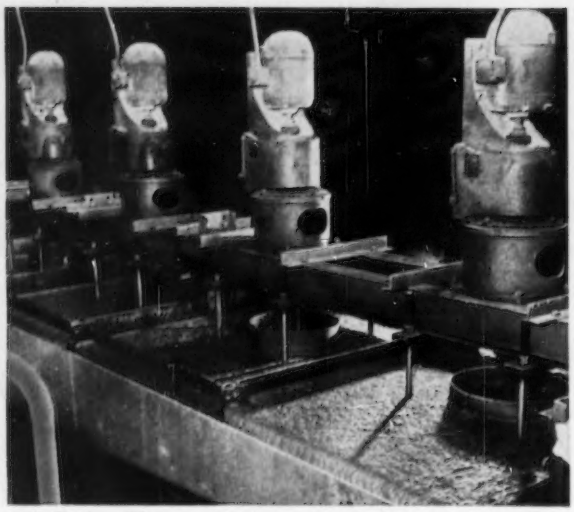
Turbo-Topics

TURBO-MIXER GENERAL AMERICAN TRADE MARK

TURBO-MIXER, a division of

GENERAL AMERICAN TRANSPORTATION CORPORATION

Leach Tank Agitators at Vitro Uranium Division of Vitro Corporation, Salt Lake City, Utah.



27" Turbo—Flotation Machines on potash at the Carlsbad plant of the Potash Division, International Minerals and Chemical Corporation.

high production low maintenance with TURBO on the job

Peak production requires *continuous heavy duty service . . .* especially for minerals beneficiation and extractive metallurgy. That's why leading firms such as International Minerals, Nickel Processing, Vitro Uranium and American Smelting and Refining choose Turbo-Mixers.

Many Turbos are on their second 100,000 hours of 24-hour continuous service with no more than normal scheduled maintenance. A Turbo engineer is available to work with your engineers for your *high-production low maintenance program.*

• Send for descriptive information showing how Turbo-Mixers can increase your production efficiency at lower cost.

SALES OFFICE: 380 MADISON AVENUE, NEW YORK 17, NEW YORK

General Offices: 135 S. La Salle St., Chicago 90, Illinois • Offices in all principal cities

OTHER GENERAL AMERICAN EQUIPMENT:—DRYERS • DEWATERERS TOWERS • TANKS • PRESSURE VESSELS

Pit-and-Plant Housekeeping needs doing every day!

Your clean-up tasks pay no direct profits, but, if neglected, they can give you ore grading troubles, increase hauling costs, add to equipment-maintenance, and cause downtime that cuts production. One man and a modern motor-grader can do all these necessary "housekeeping" chores day-by-day . . . save expensive man-hours and production delays before the condition gets so bad it must be dealt with as an emergency involving costly repairs.

That is why we recommend the use of a modern Adams grader on a regular program of mine housekeeping. Here is a list of everyday assignments you probably include among your "housekeeping" problems:

1. **Haul-road maintenance . . .** saves tire-wear, speeds hauling, improves safety, keeps production rolling, cuts costs, increases profit.

2. **Clean-up of pit floors . . .** permits driving equipment by shortest route, saves wear on tires and crawlers, improves pit drainage, keeps dirt and refuse from weathering into lower levels of ore.

3. **Clean-up after blast . . .** the sooner scattered fragments from blast are moved back against toe, the safer for men, tires, and machines that move around your pit.

4. **Clean ore-benches of washed-down dirt . . .** the better your grade of ore, the better your price. Leaving silica and other washed-in debris on your benches invites it to wash into cracks, crevices, and drill holes in your ore. Prompt grader-service stops further "wash", piles the material for easy removal by scraper or truck.

5. **Keep concentrating-plant area clean . . .** safe to work around . . . drive around. There is occasional spill over the sides of heaped trucks, around conveyors, grizzlies, hoppers, trestles, and it pays to clean it up . . . daily. Keep roads, runways, and working areas around the plant neat, clean, and workable.

6. **Keep toes of stockpiles pushed in . . .** they contain valuable merchandise. Weather and loading operations tend to spread your stockpiles, eat up valuable workspace, waste stored material. To load from this thinly spread toe gives inferior grades, increases loading cost. A few minutes work with a motor-grader once or twice a week keeps your stockpiles clean, gives more work-room.

7. **Keep drainage open . . .** don't let puddles stand. Your pit area continually needs new drainage ditches. As old ditches fill, you need to clean them out. The best answer to ditch problems is the modern motor-grader. Watch an Adams grader work . . . you'll quickly see why a few hours a week with an Adams will keep your ditches clean and your pit dry.

8. **Level and spread on dumps . . .** means that trucks drive faster coming on . . . and faster off . . . safer, too. Adams spreads material clear over the edge with offset blade that reaches far out beyond leaning wheels that hold against side thrust. An Adams travels up to 25 mph . . . doesn't take long to get up on the dump, clean-up, and get back to the pit, working the haul-road both ways.

9. **In winter,** blade-grading of snow and ice quickly cleans pit and plant roads for safe, fast hauling. If there are drifts to lick, a V-plow attachment on your Adams grader helps open blocked roads quickly.

10. **For exploration teams,** a modern motor-grader to maintain haul-roads is a "must". Once heavy clearing is out-of-the-way, an Adams heavy-duty grader can build you a mile of well-graded-and-drained highway in a matter of hours.

It may be a good idea now to check your pit and plant housekeeping. Check, too, your available graders . . . compare them with the work-ability and versatility of a modern Adams. Perhaps it's time for a change? A new broom sweeps clean . . . a new Adams could revitalize your housekeeping program! Write for further information. And if you'd like reprints of this advertisement to use in discussing "housekeeping" with your staff, just tell us how many copies you need.

A size ADAMS for every need

Model 660—150 hp diesel engine, 27,730 lbs.
Model 550—123 hp diesel engine, 23,500 lbs.
Model 440—104 hp diesel engine, 21,500 lbs.
Model 330— 80 hp diesel engine, 20,500 lbs.
Model 220— 60 hp diesel engine, 14,865 lbs.

Adams optional equipment includes dozer blades, scarifier, snow plow, and snow wing

Good haul roads speed hauling, save tire wear and truck maintenance, improve safety. Adams graders do this work fast, at low cost.

AG-6-M-b

LeTourneau-WESTINGHOUSE Company, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

ARBA See you at the ROAD SHOW • Chicago • January 28-February 2, 1957

Serving Both Hemispheres

faster

Royal Blue
has won acceptance *faster* than any other wire rope in Roebling history

John A. Roebling's Sons Corporation, Trenton 2, N. J., Subsidiary of The Colorado Fuel and Iron Corporation BRANCHES: ATLANTA, 934 AVON AVE. • BOSTON, 51 SLEEPER ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATI, 2340 GLENDALE-MILFORD RD., EVENDALE • CLEVELAND, 13225 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST. • DETROIT, 915 FISHER BLDG. • HOUSTON, 6216 NAVIGATION BLVD. • LOS ANGELES, 5340 E. HARBOR ST. • NEW YORK, 19 RECTOR ST. • ODESSA, TEXAS, 1930 E. 2ND ST. • PHILADELPHIA, 230 VINE ST. • PITTSBURGH, 1723 HENRY W. OLIVER BLDG. • SAN FRANCISCO, 1740 17TH ST. • SEATTLE, 900 1ST AVE. S. • TULSA, 321 N. CHEYENNE ST. • EXPORT SALES OFFICE, 19 RECTOR ST., NEW YORK 6.

Serving Both Hemispheres

of the Mining World

CYANAMID

REAGENT NEWS

"ore-dressing ideas you can use"

AEROFLOAT® 31 *Promoter*
Replaces Xanthate at Modern Pb-Zn Mill-
Cuts Reagent Cost, Increases Recovery

Through the able technical assistance and friendly cooperation of a Cyanamid field engineer, one of the world's most modern lead-zinc operations (pictured above) is now saving better than $50 per day in reagent costs, and recovering an additional several hundred dollars per day of lead and zinc. This added profit resulted from the conversion of both lead and zinc circuits from the use of xanthate to AEROFLOAT 31 Promoter, and elimination of lime in the zinc circuit.

The test work leading to this change-over, and the conversion itself took less than a week, with the Cyanamid engineer on the job during that time to aid plant personnel.

Perhaps a Cyanamid representative can show you, too, how to effect savings in reagent costs and improve your plant metallurgy. For the name of the representative nearest to your operation, contact any of the offices listed.

AMERICAN CYANAMID COMPANY

MINERAL DRESSING DEPARTMENT

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

Cable Address – Limenitro, New York

NORTH AMERICAN CYANAMID LIMITED
160 Bloor Street East, Toronto 1, Ontario, Canada
CYANAMID DE MEXICO, S. A.
Apartado No. 26012, Mexico 12, D. F., Mexico

CYANAMID PRODUCTS, LTD., Bush House,
Aldwych, London W. C. 2, England
SOUTH AFRICAN CYANAMID (PTY.) LTD.,
P. O. Box 7552, Johannesburg, Union of South Africa

E. P. CADWELL, Belen 1043,
Of. 6, Lima, Peru
G. B. O'MALLEY, MALCOLM GLEN,
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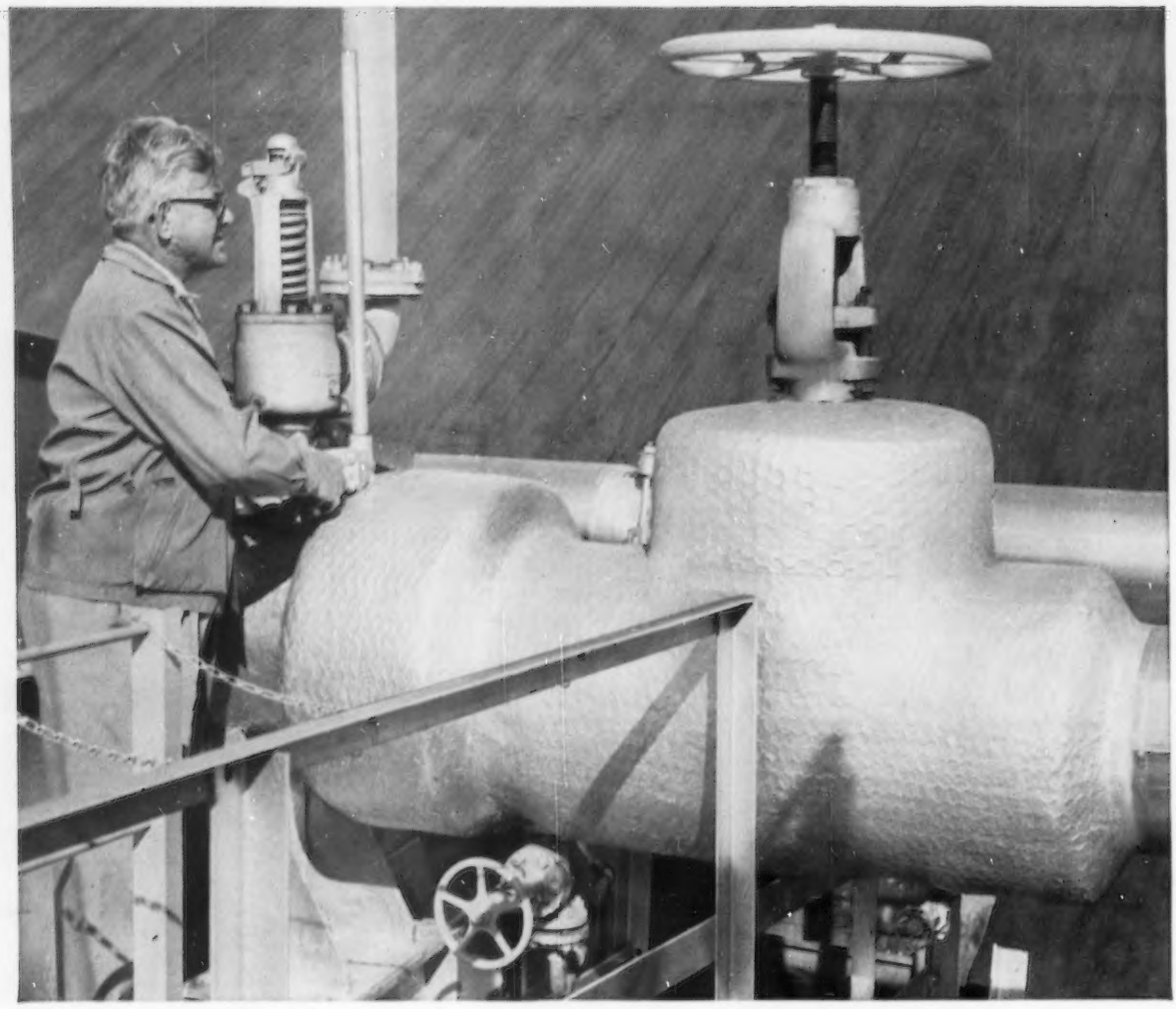

This Crane valve has 20-year cost-free record on 400 psi. steam at 750° F.

Twenty years on this high-temperature steam boiler outlet service with never a wrench on it—that's valve performance in any man's language.

This Crane 8-inch No. 179U cast steel stop-check valve has racked up just such a record at Fort Bend Utilities Co., Sugar Land, Texas, and is working as smoothly today as it did two decades ago.

The Fort Bend Utilities plant—a subsidiary of the neighboring Imperial Sugar Co.—finds this Crane stop-check an important aid to boiler efficiency.

Its high-lift disc permits maximum flow-through, with minimum pressure drop under varying load conditions. Seating is instantaneous on back flow.

On manual closure, about once yearly for boiler servicing, the valve has never failed to respond smoothly and seat tightly.

To valve users experienced with Crane quality, this performance record is not so unusual. Thousands of Crane stop-checks throughout industry are giving similarly outstanding service.

The superior materials, the top-flight engineering and construction designed into all Crane valves give them service capacity and durability second to none.

Get these advantages next time you order valves: specify Crane and be *certain* of the valve service you want. Consult your local Crane Representative or write to address below.

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Eimco 630 Tractor-Excavator is air powered for tunnel operation.

EIMCO 630 EXCAVATORS SPEED DEVELOPMENT

High speed development can be maintained underground with only the normal shift crew. The Eimco 630 helps the miner or contractor realize this goal because it operates faster and requires no track.

The Eimco 630 Excavator is mounted on the Eimco 630 air or electric (A.C.) powered tractor and the combination unit provides the operator with a really mobile and versatile loading machine.

With its independently controlled tracks the Eimco 630 Excavator can dig in at the toe of the muck pile, bulldoze out into stations cut along the side, walk over, around and through unworkable areas in the mine eliminating the necessity for laying rails.

It is also in use for shaft sinking in round and rectangular shafts. It is being used on slopes and for mucking out sub-level ore pockets.

In all of the applications where the 630 has been employed the costs of handling the material have been less than with previously used equipment.

The Eimco 630 is rugged, requires a minimum of maintenance attention and has the same dependability that has been characteristic in Eimco made equipment for more than half a century.

Write for complete information.

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

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EIMCO

B-206

"Stainless Steel has increased our efficiency"

SAYS R. G. SMITH, PRESIDENT, NATOMAS COMPANY, GOLD DREDGING DEPARTMENT, NATOMA, CALIFORNIA

Natomas operates five one-and-a-half million dollar dredges—each about 158 feet long and 58 feet wide with a weight of 2700 tons. The dredges operate 24 hours a day, every day of the year except Christmas and July 4th.

Every day, about 18,000 tons of sand and gravel churn through the dredge, an operation that surely must be one of the most punishing in the mining business.

The ore passes through a 45-foot trommel, then over the jig screen for screening and concentration. There are more than 30 of these screens, 3′ 6″ wide and 3′ 6″ long, containing .101″ openings.

Until 1947, the screens were made from ordinary carbon steel mesh. They rusted, roughened and eventually clogged. Operations stopped while the screens were cleared. In 1947, Natomas substituted USS Stainless Steel screens in this vital operation, and all the old problems vanished. Despite the higher cost of Stainless, the *cost per ton* of ore is lower than ever before.

Stainless Steel is the great all-around metal. No other material can match its combination of corrosion resistance, strength, smoothness and easy fabrication. And if you want to be sure of service-tested quality, specify USS Stainless Steel.

Stainless jig screens are in background. Half-inch ore passes over the screens, then over the cutting plates (center), then over the riffles in foreground.

UNITED STATES STEEL CORPORATION, PITTSBURGH • AMERICAN STEEL & WIRE DIVISION, CLEVELAND • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
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USS STAINLESS STEEL

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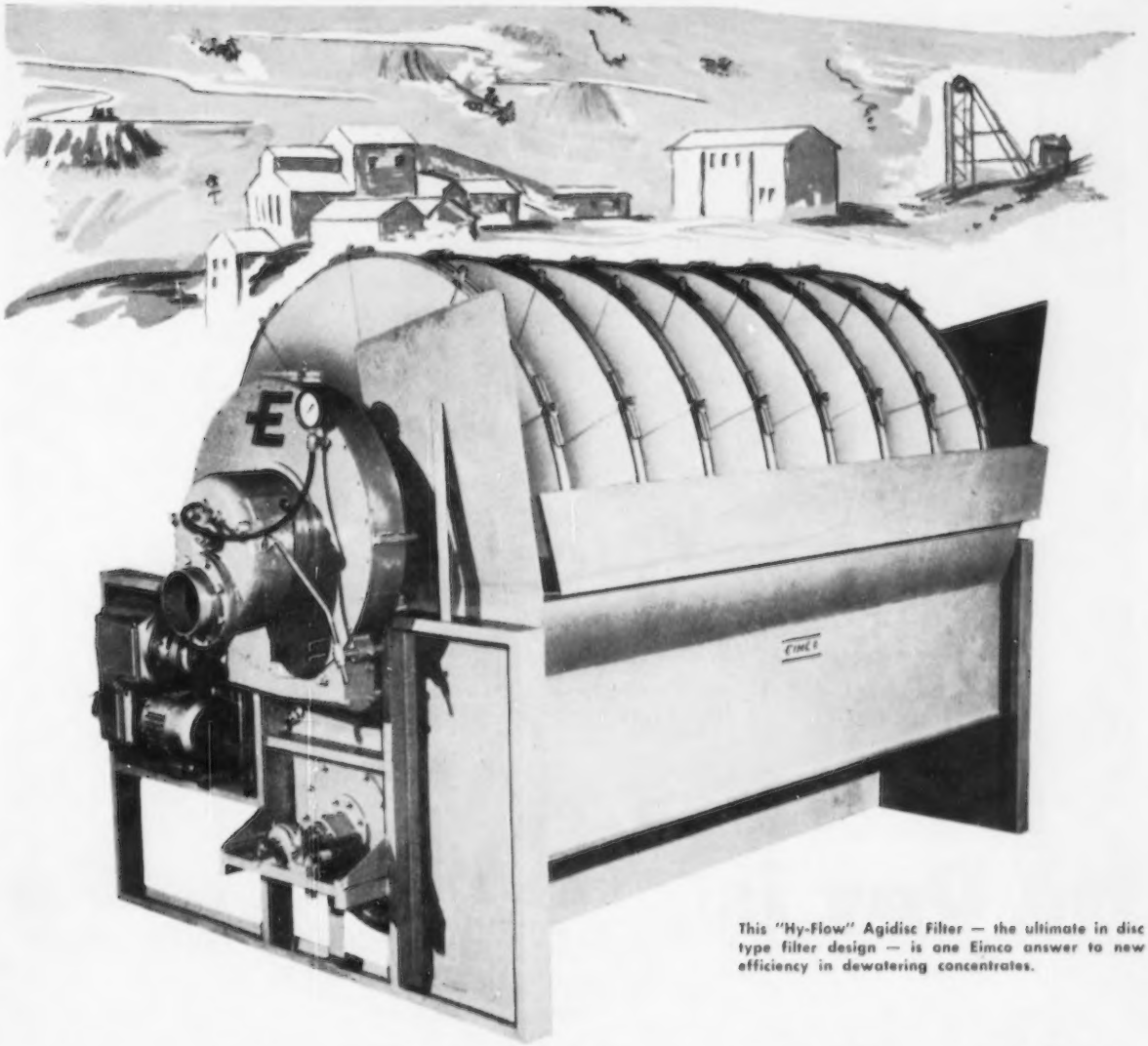

This "Hy-Flow" Agidisc Filter — the ultimate in disc type filter design — is one Eimco answer to new efficiency in dewatering concentrates.

EIMCO "HY-FLOW" AGIDISC NEW DESIGN FOR IMPROVED FILTRATION

Application of the Eimco "Hy-Flow" design to Agidisc filtration is proving to be a practical and money-saving formula for filtering many metallurgical concentrates.

This new design, which enhances operating efficiency in all zones of the filtration cycle, combined with the Agidisc's ability to maintain constant particle suspension, makes the Eimco "Hy-Flow" Agidisc a highly versatile filter.

Enlarged ports, streamlined passages and direct flow allow an unrestricted passage of liquids and gases from the filter media through the valve.

Also eliminated is vacuum loss, since turbulence and right angle resistance bends are no longer present.

The "Hy-Flow" Agidisc incorporates newly designed valves, disc sectors, sector bells and trunnion barrels.

Eimco filtration engineers can produce comparison records to show that "Hy-Flow" Agidisc filtration has dewatered tonnage to a lower moisture content at lower cost than any other filter.

If your operation involves dewatering fast settling solids, the Eimco "Hy-Flow" Agidisc Filter could well be your solution to better filtration resulting in more profit.

Send your particulars to the Eimco Filtration Division. Their advice to you will be based on years of research and experience in the field.

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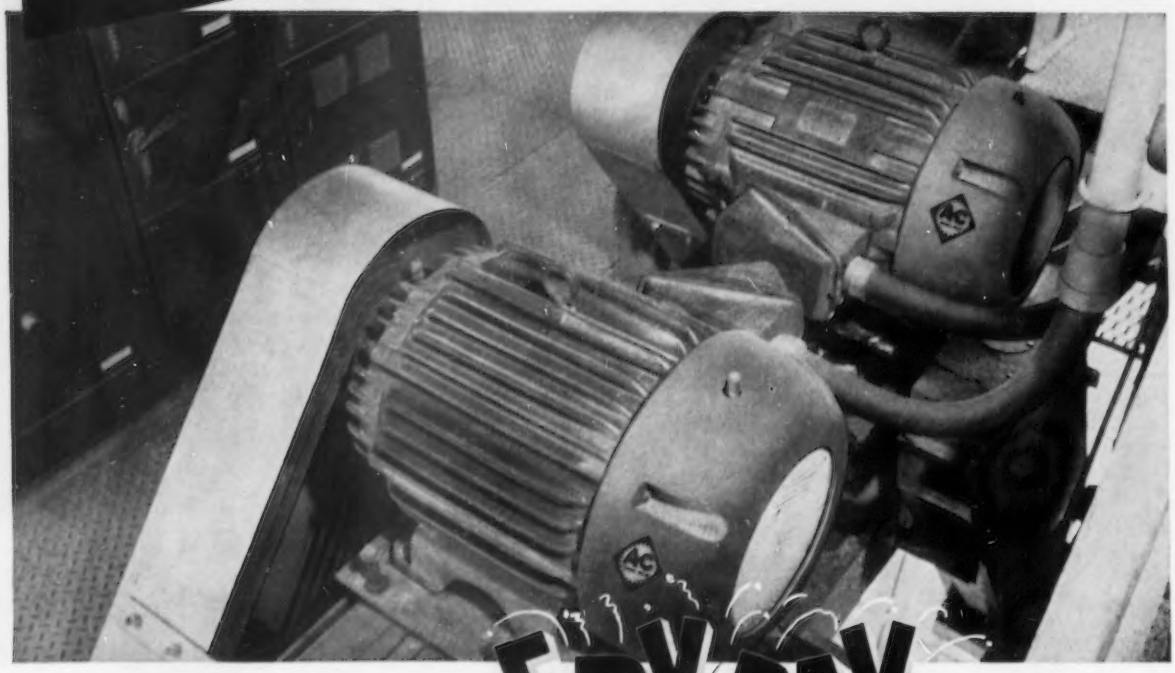
B-206

There's **MORE** Cooling Surface in these deep-ribbed **MOTORS**



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A-4940

QUEBEC HYDRO-ELECTRIC COMMISSION USES EIMCO 105 TRACTOR-EXCAVATORS ON BERSIMIS PROJECT

The Quebec Hydro-Electric Commission supplied contractors on the huge Bersimis project with several Eimco 105 Tractor-Excavators as the most efficient machines available for certain phases of the job.

Eimco 105's worked on the penstocks at the powerhouse, loaded blasted rock at the diversion tunnel, mucked in the intake shafts, assisted in clean up of the main tunnel, loaded aggregate from the quarries and accomplished numerous other jobs including, (as shown above) the takeup of the bottom in the main tunnel.

The main tunnel bore at Bersimis is 7 miles long and excavated diameter was 45 feet. The intake shaft on the Diversion tunnel was 32 feet in diameter by 120 feet deep. The Bersimis project is scheduled to generate power by July or August of 1956.

Contractors have worked steadily in the face of adverse weather conditions to complete this great work at an early date. Eimco extends its heartiest congratulations on a job well done.

Eimco 105 Tractor-Excavators are at work throughout the world on Hydro-electric development projects, mines, roadbuilding, stockpile loading, pits and quarries and many other rough jobs. In many instances, the 105 is the only production equipment on the job—because its dependability is a well known and proven fact.

If your project calls for a tractor, bulldozer, or excavator, you'll want Eimco to supply you with full information about the versatile 105. Just send details of your project. You'll find, as have many others, that Eimcos will do the job faster, cheaper and better.

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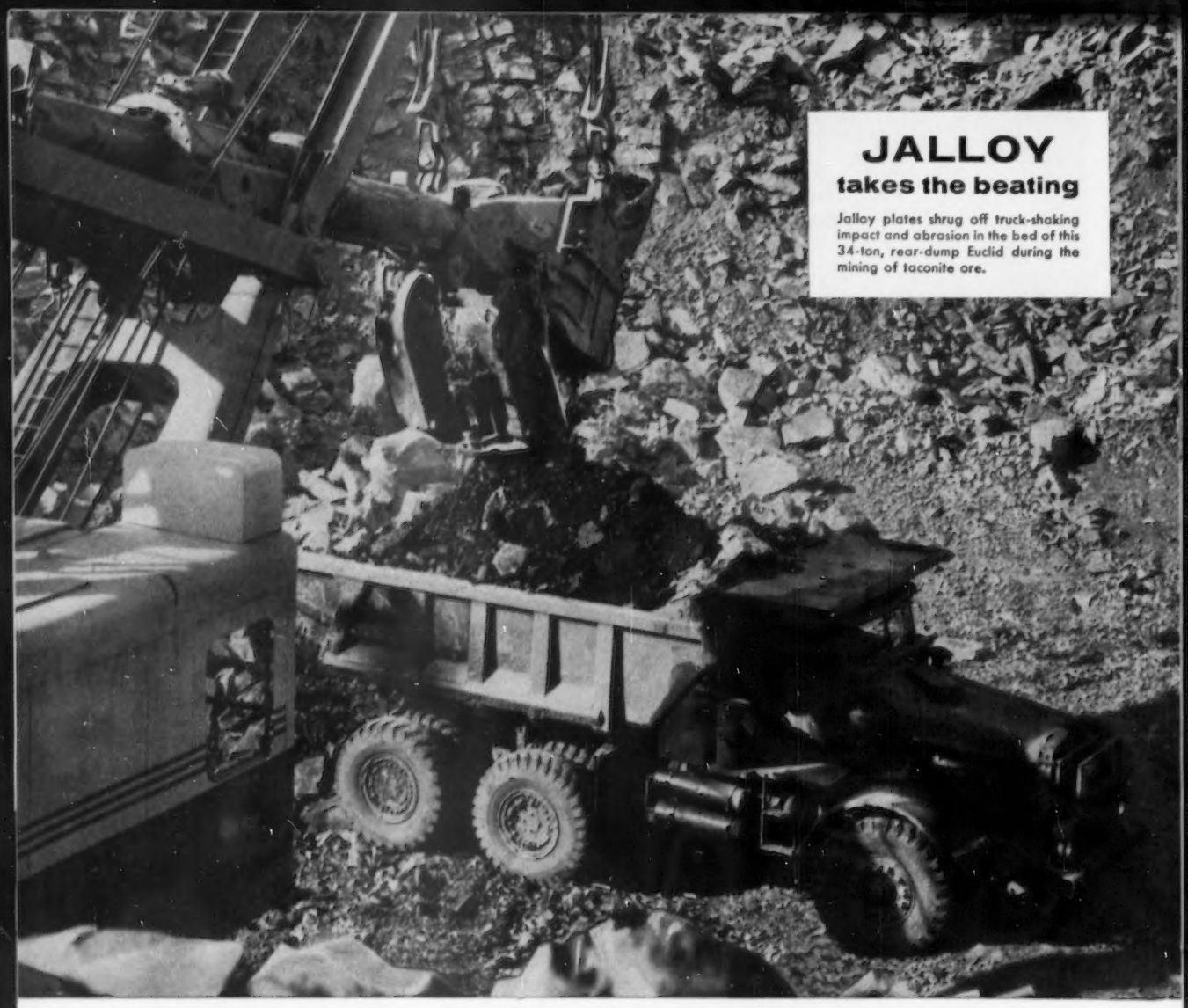
EIMCO

B-812



JALLOY
takes the beating

Jalloy plates shrug off truck-shaking impact and abrasion in the bed of this 34-ton, rear-dump Euclid during the mining of taconite ore.

Jalloy heat treated steels . . .
cut maintenance—give longer wear life

Jalloy—special purpose steels that are heat treated to provide longer wear on applications where impact and abrasive conditions are severe—last 4 to 20 times longer than conventional mild steels. Furthermore, they are easily welded.

Jalloy is available in three grades:

No. 1—for applications requiring excellent formability or where a low carbon alloy steel possessing good physical properties before or after heat treatment is specified. This is an ideal carbonizing grade.

No. 3—a general purpose steel capable of being heat-treated to excellent physical properties. Compared to ordinary mild steels it offers good resistance to abrasion or wear in the as-rolled state; but when heat treated to Brinell 340 and above, optimum abrasion and impact resistance is secured.

No. 7—possesses high hardness together with good ductility or wear resistance. Excellent for spring applications as well as flat work.

Jalloy high strength steels are available as plates, structurals, bar and small shape sections, hot rolled sheets, as well as strip and wire products.

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Complete data concerning *Chemical Composition . . . Heat Treatment . . . Weldability . . . Physical Properties . . .* will be mailed to you promptly. Write today for your copy.

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J&L STEEL

"We do '4-hr. jobs' in 2 hrs. with our new TD-9 Skid-Shovel"

—Beatrice Concrete Co.
Beatrice, Nebraska

"Snappiest loader on the market"
Hoosier Lime and Stone Co., Salem, Indiana, added a bonus-powered International Drott TD-9 Skid-Shovel to load crushed stone, level overburden, do custom excavating. "This is the snappiest tractor shovel on today's market," states Operator Lawrence Rutherford. "The new TD-9 Skid-Shovel lifts faster, has more engine power, plenty of operator room and comfort, operates easier, has much better vision."

"Plenty of power . . . perfect vision"
This new TD-9 Skid-Shovel loads 12 to 15 tons of zinc ore from stockpile, every 3 or 4 minutes. Turley and Yates, Rutledge, Tenn., also dig basements, clear and drain land, do custom loading with it. Says Partner Joe E. Yates: "It's fast, easy to operate, has plenty of power, and perfect loading-cycle vision. Hydro-Spring is a life-saver to unit and operator. Roomy seat and handy controls increase output, reduce tiring."

"First thing we noticed about this new International Drott was that it does former '4-hour jobs' in 2 hours," reports Supt. Eldon Chamberlain. "Watching it showed why it doubles production. This new rig fills a bucket easier and faster with pry-action break-out. Operator has better control, watches bucket action more easily—and added hp does top speed work with no strain on machine or operator."

This ready-mix concrete company also excavates and grades—digs basements, backfills, and loads spoil dirt. They recently replaced their older crawler-loader with a new International Drott TD-9 Skid-Shovel.

See how exclusive pry-over-shoe break-out action—now increased to 10,000 lbs. in the International Drott TD-9 Skid-Shovel—gets you the "too-tough-for-others" jobs; helps outproduce 'em anywhere. Prove exclusive, shock-swallowing Hydro-Spring as a cost-cutting yardage-booster. Or, try an exclusive Four-In-One Skid-Shovel—4-machine utility, one moderate investment. Ask for a demonstration!

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You are looking at a new kind of on-and-off-the-road truck tire. It is so *immune* to road hazards it runs over razor-sharp axblades without losing a pound of air. It has the deepest tread U. S. Royal has ever built into this type of tire. It is so *versatile* it outperforms on any wheel—gives greater stability on front wheels, increased traction on drive wheels, extra recaps on trailing wheels.

For dump trucks, transit mixers, log haulers . . . on any rig exposed to heavy impacts, tire-killing terrain. You'll enjoy fewer tire failures, less down-time expense, greater service dependability.

In sizes through 11.00. See your U. S. Royal Dealer . . . or write Truck Tire Department. You can specify "Super Fleetmaster" on your new equipment.

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Gardner-Denver . . . Serving the World's Basic Industries

Lightweight powerhouse for low-cost drilling

Here's the lightweight drilling combination that's easily carried into far corners of the mine—enables one man to run in a remarkable footage record during the shift. Consists of the lightweight FL-48 or FL-58 Sinker mounted on air feed leg with feed travel of 24″, 36″, 48″ or 60″.

Lightweight Gardner-Denver drills have the proper combination of characteristics for fast drilling with tungsten carbide bits. May be equipped with Gardner-Denver air-operated water gland—throttle-controlled—that automatically provides water-on, air-on, air-off, water-off cycle.

Feed legs available with weight-saving aluminum feed cylinder. Push-button bleed for fast retraction. Single air hose supplies both drill and feed leg, and all controls are on the drill back-head.

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MOVING

the richest hill on earth

The open pit mining of copper ore from Montana's famous Butte Hill has added a new chapter to the long saga of underground mining at "the richest hill on earth."

Begun as a pilot operation by the Anaconda Company late in 1954, the open pit work has proved so successful that plans are going ahead for mining a near-surface ore reserve currently estimated at 100-million tons.

When the F & S Contracting Company of Butte were awarded this vital earth-moving job, they chose Mack LRVSW's. The popularity of these six-wheel, off-highway dumpers has been firmly established by an unmatched record of dependable and economical service. Day and night, winter and summer, these "big boys" stay on the job—handling the heaviest loads under all conditions. Mack Trucks, Inc., Plainfield, New Jersey. In Canada: Mack Trucks of Canada, Ltd.

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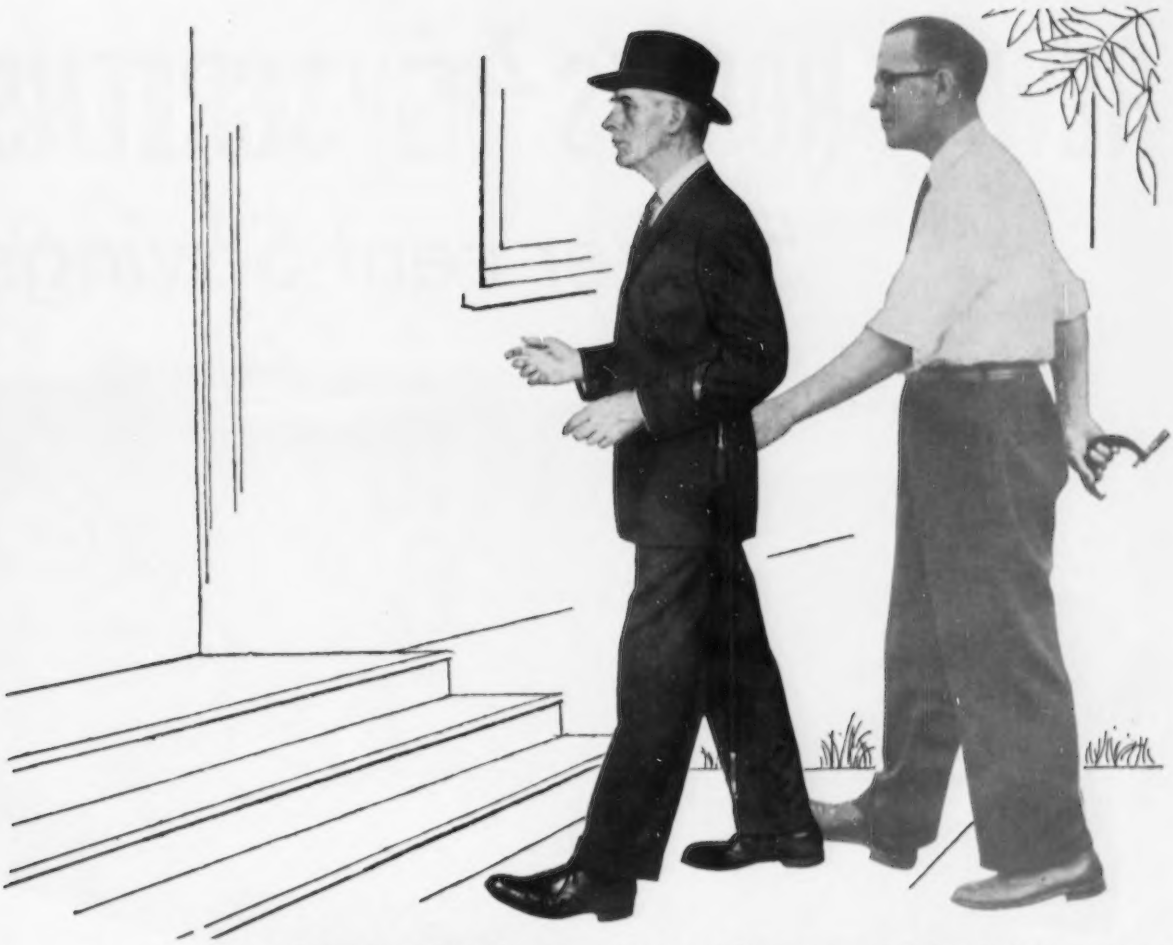


Your Wickwire Rope Distributor and our die maker... ready to serve you

This die maker—one of the skilled technicians responsible for the quality of our rope wire—is with your Wickwire Distributor every time he makes a call.

True, he's physically in our plant, working to tolerances of 1/10,000 of an inch as he fashions the super-hard carbide dies used to produce every foot of rope wire. But, whenever your Wickwire Distributor makes his call, he has the full assurance that *every* wire in the product is exactly the size it should be and has a smooth, silky surface finish. This careful attention helps assure a rope which will perform successfully.

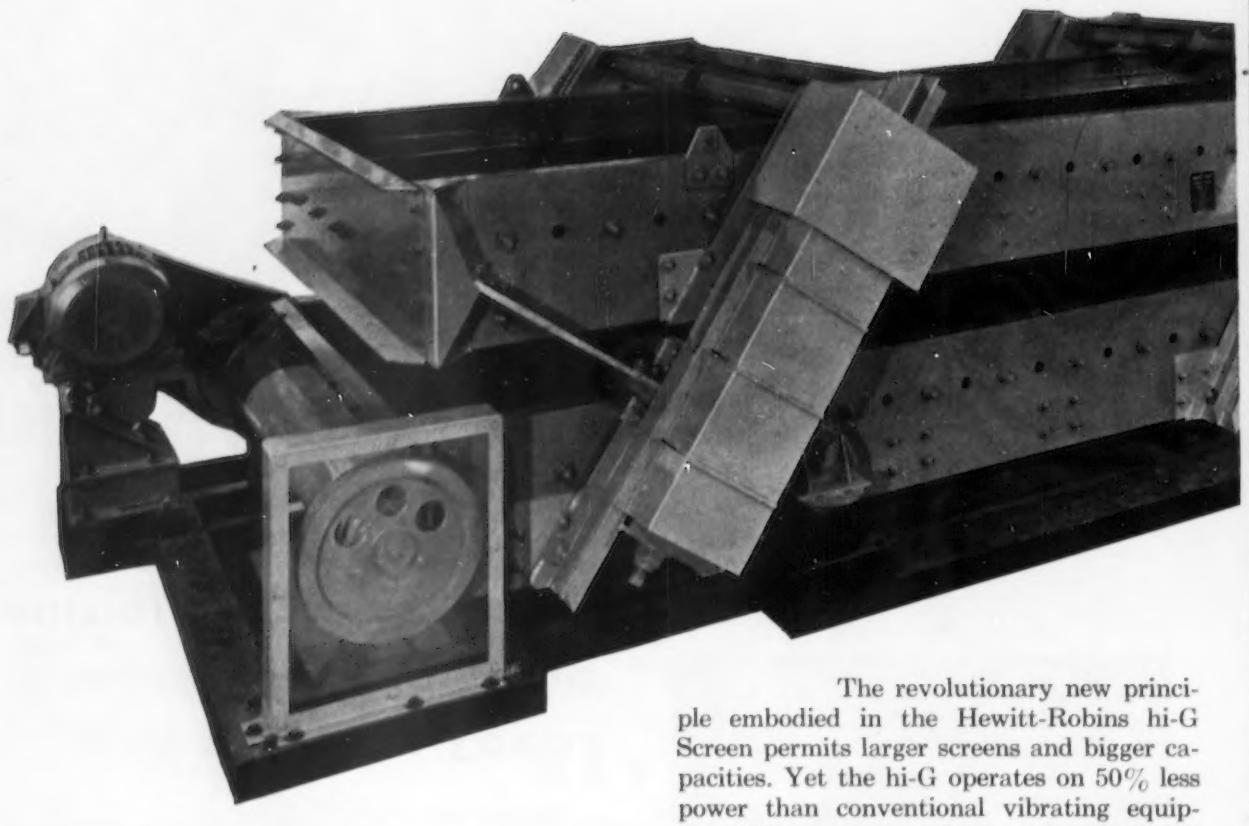
It's just one more reason why your Wickwire Distributor knows he's got top-quality rope, slings and strand to sell . . . and that these products will serve you well.

4083

A PRODUCT OF THE COLORADO FUEL AND IRON CORPORATION

HEWITT-ROBINS *hi G* SCREENS

50 Per cent Savings



The revolutionary new principle embodied in the Hewitt-Robins hi-G Screen permits larger screens and bigger capacities. Yet the hi-G operates on 50% less power than conventional vibrating equipment! Even screens as large as 6' wide by 28' long require no more than a 20-HP drive.

Featuring an unusually sharp screening action, and a choice of stroke and speed combinations, the hi-G can be made in larger sizes than any other vibrating screen on the market.

New "Modified Resonance" Principle

Utilizing the principle of "modified reso-

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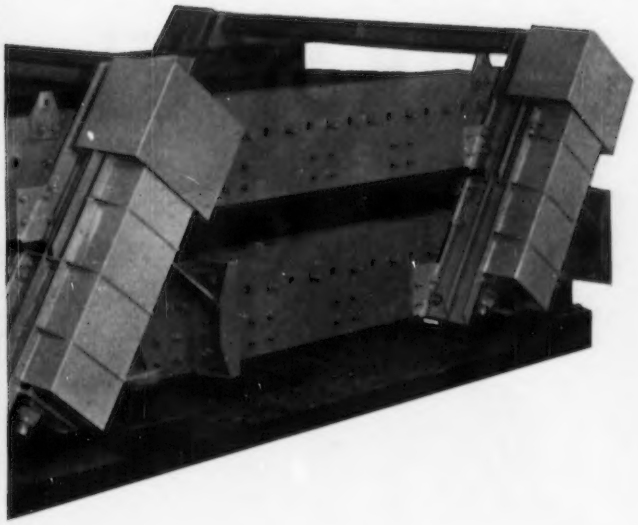
"GLIDE RIDE" THE NEW MOVING SIDEWALK

HEWITT

STAMFORD,

SAVE POWER *Possible*



nance," the new Hewitt-Robins hi-G Screen develops a controlled, extremely sharp vibrating action. This resonance is induced by a relatively small mechanical exciter producing powerful vibrations with added "kick" to separate materials according to size.

If you need larger screens—screens that operate on or near the horizontal and still screen at large openings—*screens with readily accessible lower decks for easy observation, spraypipe installation and quick cloth changes* . . . the hi-G Screen is your answer. For information about hi-G Screens and other Hewitt-Robins vibrating equipment, contact our nearest sales office or write to our offices in Stamford, Connecticut.

-ROBINS

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GYREX SCREENS. General-purpose, positive-stroke, 4-bearing screen with amazing versatility of application and an unsurpassed record for stamina in service.

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STYLE HS HIGH-SPEED VIBREX. For fine screening applications (up to 100-mesh in some cases). Highly effective circle-throw screening action.

ELIPTEX SCREENS. Exclusive 3-way elliptical motion for sharpest sizing and most effective dewatering. Horizontal-operating flat screens.

CAR SHAKEOUTS. Both Heavy-Duty and General-Service units for unloading all sorts of materials from hopper cars faster, more efficiently and more economically.

VIBRATING FEEDERS. Fully mechanical vibrating feeder. Easy to install, operate and maintain. Extremely high capacities at very low power consumption.

VIBRATING CONVEYORS. To convey practically any substance in almost any form or condition. Available in several widths up to 150 feet in length with only one vibrator.

SCREEN CLOTH. Wire cloth in a variety of sizes, weaves and materials for virtually every sizing, separating or screening operation.

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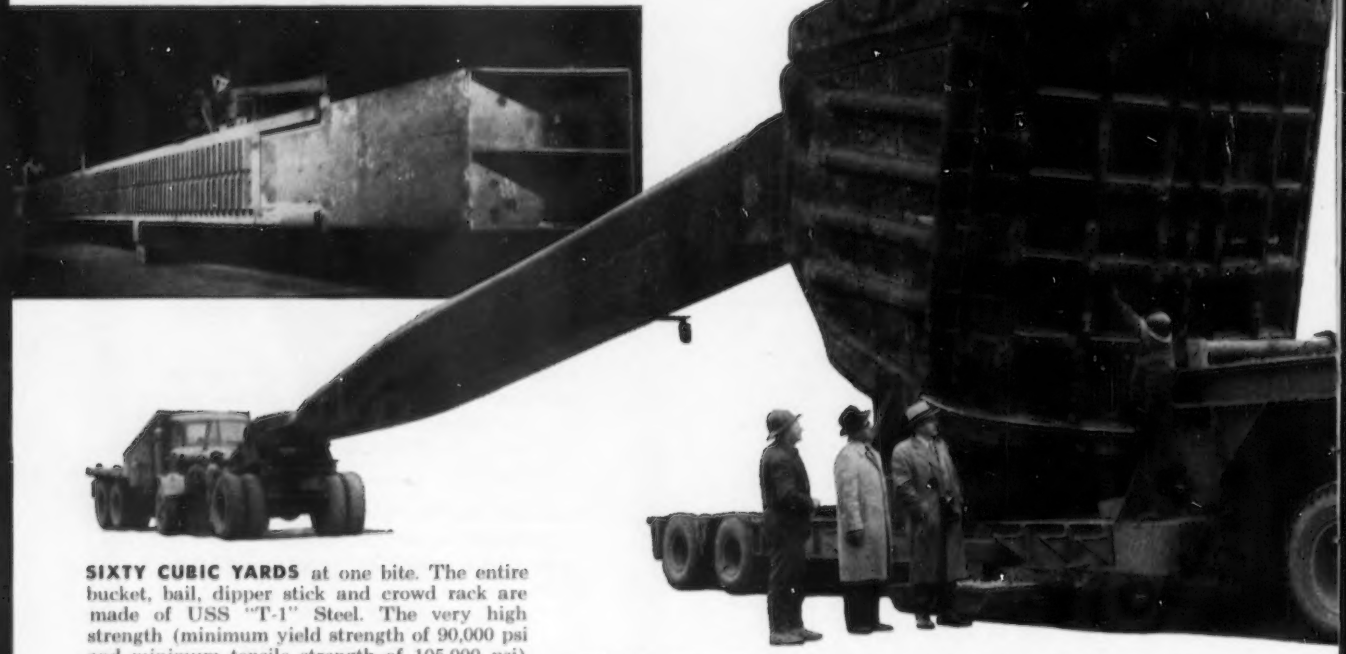
LISTED IN THE "YELLOW PAGES"

To move more dirt USS "T-1" Steel is used in WORLD'S LARGEST POWER SHOVEL

WORLD'S LARGEST power shovel is the new Marion Type 5760. With a 150-foot boom, and a dipper capacity of 60 cubic yards, it has a working weight of about 5,500,000 lbs. Hanna Coal Co. is using it to strip over-burden to an average depth of 90 feet.

CROWD RACK is 42 feet long, made from seven pieces of USS "T-1" Steel 6½" x 34½" x 73½". Gear teeth are machined into these sections, then the pieces are heat-treated, flattened, finish-machined, and welded together. The "T-1" rack is stronger than a cast rack would be, eliminating the fear of breakage and deformation.



SIXTY CUBIC YARDS at one bite. The entire bucket, bail, dipper stick and crowd rack are made of USS "T-1" Steel. The very high strength (minimum yield strength of 90,000 psi and minimum tensile strength of 105,000 psi) of "T-1" Steel enabled the designers to combine maximum strength with lightweight construction. Result: *Capacity*. Thanks to USS "T-1" Steel, the bucket moves more dirt than any other shovel bucket in the world.

UNIQUE. USS "T-1" Steel's unique combination of high strength, extraordinary toughness, resistance to impact and abrasion, and excellent weldability helped spell efficiency and operating economy in this shovel. "T-1" Steel is finding wide application in mining and construction equipment, bridges, pressure vessels, and other products where light weight, extreme ruggedness, and durability at low temperatures are needed. USS "T-1" Steel's ease of fabrication cuts costs in many applications. Write for more information. United States Steel, Room 5357, Pittsburgh 30, Pa.

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UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS "T-1" CONSTRUCTIONAL ALLOY STEEL

USS

UNITED STATES STEEL

PREVENTION OF ACCIDENTS IN THE USE OF EXPLOSIVES
Approved by the Institute of Makers of Explosives, September 30, 1955
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WARNING:
DEFINITIONS

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Everyone who has anything to do with explosives should have a copy of this new, revised, up-to-date list of *instructions and warnings*, approved by the Institute of Explosives Makers.

It covers important functions in the handling and use of explosives—*lists 72 Do's and Don'ts* for prevention of accidents in handling, transporting, storing, loading, tamping, shooting and disposal.

Contains vital precautions when shooting either electrically or with cap and fuse . . . eleven suggestions for minimizing poison gas hazards . . . prevention of misfires . . . approved methods for priming. Send for your *free copy today!*

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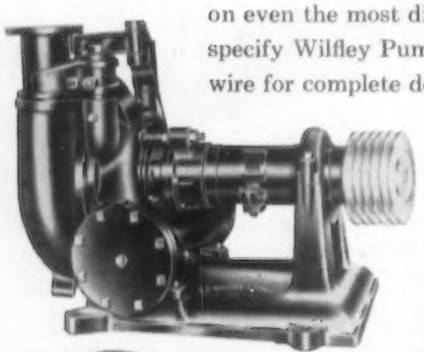
Supersonic aircraft, guided missiles and rockets require special heat-resistant alloys. Many of the essential ores used in the production of these alloys are handled efficiently and economically by Wilfley Sand Pumps. For continuous, trouble-free performance on even the most difficult pumping jobs—specify Wilfley Pumps. Write or wire for complete details.



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ENGINEERING AND MINING JOURNAL

AUGUST 1956

This Is No Time To Be Speechless

EGYPT'S SUDDEN RASH SEIZURE of the Suez Canal has jolted the world, and set loose fears that confiscation of foreign-held or operated property might become contagious elsewhere in Arab states.

However it does not necessarily follow that Egypt will follow up seizure with an imprudent crackdown on the world trade which passes through the Suez canal; nor that the Arab states will go on a confiscatory binge. World history shows that countries which have followed this course have soon learned to regret it.

Bolivia's improvident confiscation of tin properties has set that country back tremendously, and it is now appealing for foreign capital and know-how to mend its broken economic fences. Mexico's "appropriation" of oil properties has prejudiced the flow of foreign capital and enterprise through its borders and greatly retarded development of its industries and natural resources.

By way of contrast, note how Venezuela has been rewarded with unprecedented prosperity because it has provided a favorable economic climate for foreign enterprise. The same applies to Arab states which encourage the exploration and production of oil.

Many other examples could be cited to show how countries in the Western Hemisphere, South Africa and elsewhere have prospered because they have established mining codes and tax climates which have attracted foreign mining capital. But unfortunately, the great contributions which mining companies are making by way of townsites, recreation facilities, hospital and preventive medical programs, schools, training programs, water supply, transportation, widespread employment and ample and highly nutritional food supplies have not been widely publicized.

One reason for this lack of favorable publicity is the tendency of the mining industry to underestimate the importance of a good public relations program. Some large companies do not even have a public relations department or public relations officer. In other companies, this function is regarded as a distinctly minor one.

Fortunately, the mining industry is waking up to this deficiency, and today a number of important mining companies have established strong public relations departments. This trend is growing, but not nearly fast enough to prepare for the various types of crises that could shape up to affect the mining industry adversely. Low depletion allowances, L-208—which unjustifiably shut down our domestic gold mines, excessive tax rates in foreign countries, confiscation etc. are but a few of the factors that have sideswiped our industry in the past. These are the factors that our industry must foresee in the future and combat by cultivating a sympathetic attitude toward the industry by legislators, government agencies, and the public at large.

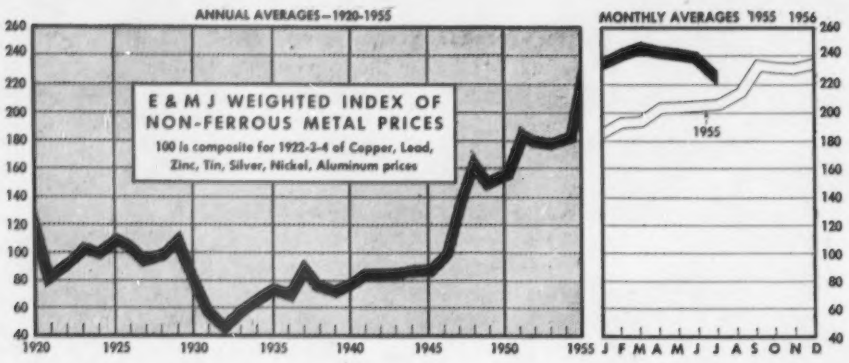
The mining industry certainly does not have to apologize for its tremendous contribution toward society and international security, but it may suffer because this fact is not widely known nor appreciated.

One word of caution—public relations must not be confused with propaganda. The industry must set up enlightened policies which it can be proud to talk about, and then proceed to do so.

Many appeals are made to *E&MJ* to serve as a public relations outlet for the mining industry. Our staff is always willing and eager to tell about the fine things the mining industry is doing, and to give background information to TV broadcasters, leading national magazines and groups seeking to invest in the mining industry. But this is not enough. Each mining company must make its contribution toward the better understanding of the mining industry by the public at large.

E&MJ OUTLOOK

PRICES



MARKETS

E&MJ's metal price index slumped 12.81 points last month from 242.58 for June to 229.77 for July. The big drop in copper prices accounted for the decline. This is the fourth consecutive monthly drop from the all-time high of 248.28 for March.

●

AT HOME

ODM will pay premium prices to stimulate plant expansion for nickel production in the U. S. and abroad. The Government hopes to boost available nickel supply from the present level of 300-million lb per year to about 440-million lb by 1961.

Arthur G. McKee & Co. has obtained rights to design flash roasting plants for copper and nickel in North and South America employing the process developed by Outokumpu Oy of Halsinki. McKee's Canadian subsidiary has been awarded a contract to engineer and supervise construction of a copper-nickel flash smelter at Chicoutimi, Quebec, by Eastern Mining & Smelting Co.

U. S. is now the leading producer of uranium in the free world according to AEC's latest semi-annual report.

AEC has set down rules to let qualified people in on its project to develop power from hydrogen by the fusion process. Up to now some 99 companies, mostly utility, have applied for access to fusion information.

●

LABOR

Mine-Mill is coming out ahead in the contest with the Steelworkers union for representation rights in the nonferrous mining industry. See p 121.

Higher labor costs resulting from increases granted in the steel industry will boost steel prices about $10 per ton. Equipment fabricators say they are in no position to absorb an increase of this size, so the tab will be passed on to the consumer.

●

ABROAD

British and Gold Coast governments are optimistic about the feasibility of putting through a $644-million hydroelectric project for the production of aluminum from West African bauxite. If the plan materializes, Aluminum Ltd. of Canada will participate in the project.

Nickel Processing Corp., National Lead Co. subsidiary, plans to increase nickel output at Nicaro from its present rate of 31,460,000 lb (1956 fiscal year production) to 49-million lb by expanding plant capacity by 75%.

A Japanese aluminum firm plans to send a mission to Venezuela to investigate possibilities of putting up a plant to make aluminum from bauxite in the state of Bolivar. Kaiser, M. A. Hanna, Reynolds and Alcoa are also interested in similar projects.

Kaiser Aluminum & Chemical Co. has offered proposals to President Kubitschek to build an aluminum plant near the Paulo Alfonso power plant in Brazil.

U. S. Producers Drop Copper to 40c; World Tensions Strengthen Europe

JULY ECONOMIC ACTIVITY was reduced largely owing to the steel strike. Because of heavy inventories held by steel users, the effect on other manufacturing industries was not great. Only manufacutring and mining industries are included in the Federal Reserve Board's index of industrial production which we estimate to be down to about 138 to 139% of the 1947-'49 average.

Aside from the steel strike, other economic easing was evident. Only to some extent were these attributable to the summer vacations. Output of the auto industries and other consumer durables, and residential construction, continued at a low rate for this time of year.

Nonferrous metal prices in July dropped from 242.58% of the 1922-'24 average, as measured by the *E&MJ* index, to 229.77%. The drop in the July copper average from 45.056c to 40.807c brought the figure down.

Activity in the U. S. copper industries in July was at a very low level. The great pressure from U. S. fabricators and the considerable decrease in sales of refined copper in the U. S. in recent months, led to a drop in price by the U. S. producers from 46c to 40c. Phelps-Dodge dropped for the beginning of business July 10, Kennecott on July 11 and Anaconda the end of the business day July 11. Smaller producers are sending copper to the Government, much of it under contract plus escalation which usually means about 31c per lb. Some are reported to have contracts at lower prices while others have higher.

In Europe, activity in the fabricating industries was also low except in Germany. In the U. S., statistics of copper sold to fabricators (pricings reported to *E&MJ*) were running in July at about 65 to 70% of the first quarter figures; they were also well below June which in turn had been down. Data on sales to fabricators collected by copper industry organizations suggest about the same figure. On a monthly basis, sales in Europe have not fluctuated so much. July appears much better than earlier months. During the last few days of the month and the first of August, what the trade calls scare buying moved heavy tonnages in Europe. The trouble over the Suez Canal had immediate effects on sterling and some holders of sterling moved into commodities—they got little copper but their demand for contracts on the London Metal Exchange, some traders say, pushed the LME price up about £20 (about 2½c).

The Rhodesian Selection Trust companies dropped their price to U. K. customers effective July 2 to £275 per long ton, equal to about 34⅜c a lb. It was on July 2 that the London Metal Exchange dropped to £262 bid for prompt copper. In part this drop reflected the announcement by the British Board of Trade that it would sell 36,000 long tons of copper from its stocks over the period August 15, 1956 to March 31, 1957. Some analysts say that though this had an immediate effect, the real effect would come when the metal is actually sold and starts hitting the physical market. The European fabricator on the whole, unlike the U. S. fabricator, had not accumulated heavy stocks—some had actually reduced their stocks early in the year. In July their buying, some of which was related to international political troubles and in connection with a number of strikes in Africa (all of short duration), reduced the bearish feeling especially among sellers. Katanga raised its price to about 35c a lb on July 10, to about 36c on July 13, and on July 31 to about 36.9c. The RST companies raised their price on August 1 to £300 for U. K. consumers; this is about 37½c per lb. The price increases around the end of the month were in response to the increased European buying which resulted mainly from the fear originating in the uncertain international political situation (Suez Canal, move of China into Burma) and the thought the strike at Bancroft by African workers might spread. The major U. S. custom smelter raised to 39c a lb August 3.

Statistics in short tons for U. S. fabricators using copper, for June 1955 and May and June 1956 follow:

	1955	1956	
	June	May	June
Fabricator activity			
Shipments	133,386	(a)122,253	111,109
Sales	135,685	105,366	88,854
Unfilled orders	234,578	249,352	227,097
Fabricators' refined copper			
Stocks	327,696	435,483	451,126
On order	126,703	131,023	114,223
Receipts	133,739	140,587	128,573

Copper Institute data for May and June for sellers of refined copper follow:

United States

Production:	May	June
Crude, primary	(a) 98,208	95,105
Crude, secondary	(a) 17,475	12,491
Totals	(a)115,683	107,596
Refined copper	142,445	133 543
Deliveries, refined	(a)140,587	128,573
Stock at end, ref'd	53,443	57,546

Outside United States

Production:		
Crude, primary	(a)135,755	141,262
Crude, secondary	1,133	1,136
Totals	(a)136,888	142,398
Refined copper	124,106	114,935
Deliveries, refined	113,285	105,735
Stock at end, ref'd	(a)195,922	205,412

(a) Corrected figures.

Aluminum sellers indicate some decline in business. The Economic Research Department of Reynolds Metal Co. shows the following shipments figures in millions of lb:

	Actual 1st Qtr.	Estimated 2nd Qtr.	Estimated 3rd Qtr
Sheet	392	405	350
Castings	221	190	165
Extrusions & tubing	199	195	185
Rod, bar & wire	125	130	120
Foil	50	52	55

Prices for some secondary aluminum grades rose a little late in the month. Some of these are used in steel deoxidizing and prospects of the end of the steel strike may have had an effect. Also the possible pick-up in auto output may have contributed. Some observers say the probability of strikes in primary aluminum or a price rise in primary, growng out of increased labor costs, was instrumental in the secondary price rise.

The United Steelworkers struck primary aluminum plants (Aug. 1) of Alcoa, having a capacity of about 475,000 tons per year and Reynolds Metals Co. primary plants with a capacity of about 335,000 tons. Alcoa plants of about 320,000 tons capacity on the West Coast and at Massena, N. Y. settled with the Aluminum Workers International Union —there was no strike at these plants. Reports are that Reynolds is negotiating with the AWIU at two primary plants still operating in Washington and Alabama, with a total capacity of over 100,000 tons.

Lead sales were not good, but picked up near the end of the month. There were no price changes here, but an unsettled situation in Europe pushed the London price from a low of about 13.8c for prompt bid to about 14.6c on Aug. 2.

Zinc prices remained unchanged in the U. S. However, much the same factors that pushed copper and lead prices up in Europe affected the London zinc price. It rose from a low of about 11.5c on July 3 for prompt bid to about 12c on Aug. 2. Zinc buying continued very low in the U. S. for most of July.

Nickel prices charged by the major producers were unchanged in July. Gray market prices are reported lower this month. The weakness in the metal-using industries is partly responsible. ODM announced it would, in addition to giving fast tax write-offs, encourage further nickel expansion by purchasing agreements at prices high enough to cover development costs.

Quicksilver markets were stable in July. Sellers had sold heavily ahead and buyers felt little need to buy spot metal.

Tin in London reached a high of about 98c July 31 because of the Suez Canal trouble and the threats of a strike in Malaya of tin workers. The political situation eased and the price dropped down to about 95½c on Aug. 2. It had reached a low of 91¼c in London July 3 for prompt bid. The price in the U. S. for the same reasons, rose from 92.875c on July 3 to $1.005 July 30; it then dropped.

MARKETS *(Continued)*

Average Prices July (E&MJ Quotations)

Copper:	
Electrolytic, domestic refinery	40.807
Electrolytic, export refinery	36.002
Lead:	
Common, New York	16.000
Common, St. Louis	15.800
Silver and sterling exchange:	
Silver, New York, per oz.	90.137
Silver, London, pence per oz.	78.500
Sterling Exchange, "Checks"	279.335
Zinc:	
Prime Western, East St. Louis	13.500
Prime Western, delivered (g)	14.000
Tin:	
New York Straits	96.265
New York, 99% min. (e)	95.265
Gold, per oz. U. S. price	$ 35.000
Quicksilver, per flask	255.000
Antimony (E&MJ) (d)	36.470
Antimony, bulk, Laredo	33.000
Antimony, in cases, Laredo	33.500
Platinum, refined, per oz.	$105.00
Cadmium (a)	170.000
Cadmium (b)	170.000
Cadmium (c)	170.000
Aluminum, 99% plus ingot	25.900
Magnesium, ingot	33.750
Nickel (f)	64.500

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lb.
(a) Cadmium average based on the producers' quotations.
(b) Cadmium average based on the average of the producers' and platers' quotation.
(c) Cadmium average based on platers' quotation.
(d) Domestic, 5 tons or more but less than carload lots, packed in case f.o.b. New York.
(e) Tin content.
(f) F.o.b. Port Colborne, U.S. duty included.
(g) Delivered where freight exceeds 0.5c.

"Free" Gold Market

July trade volume rose 40%. The Soviets sold 1-million oz in Switzerland and Britain. The Suez seizure strengthened all markets. Paris averaged about $2,500,000 daily, a record. Coins remained in demand everywhere with bar gold prices rather stable. South American markets were quiet, bars fell below $35 in Santiago due to scarcity of money in Chilean markets. In Bombay the price of sovereigns rose again. Pick's World Currency Report quotes on "free gold" per fine oz as follows:

	COINS		BARS (12.5 kg)	
	June 30	July 31	June 30	July 31
NEW YORK, transit	.....	.....	$35.08	$35.08
MANILA	$43.25	$43.25	36.10	36.10
HONG KONG	43.30	42.60	38.00	38.15
BOMBAY	57.00	58.00	55.00	55.25
TANGIER	42.35	42.40	34.88	34.94
BEYROUTH	43.05	43.75	35.12	35.16
PARIS	44.00	44.50	36.10	36.25
BUENOS AIRES	40.25	41.45	35.95	36.50

Note: Prices are quoted at the free or black market value of the U. S. dollar in the local markets.

Major Metals

U. S. DAILY AND AVERAGE PRICES

July 1956	Electrolytic Copper (a) Domestic	Electrolytic Copper (b) Export	Lead New York	Lead St. Louis	Zinc (f) Delivered	Zinc East St. Louis	Aluminum Primary Pig 99%	Straits Tin New York
2	45.475	37.225	16.000	15.800	14.000	13.500	24.000	93.375
3	45.425	39.350	16.000	15.800	14.000	13.500	24.000	92.875
4	Holiday	34.450	Holiday	Holiday	Holiday	Holiday	Holiday	Holiday
5	45.575	36.100	16.000	15.800	14.000	13.500	24.000	94.500
6	44.500	36.925	16.000	15.800	14.000	13.500	24.000	94.250
7	No Market	36.925	16.000	15.800	14.000	13.500	24.000	94.250
9	44.975	34.625	16.000	15.800	14.000	13.500	24.000	96.500
10	39.225	34.975	16.000	15.800	14.000	13.500	24.000	95.500
11	39.475	34.950	16.000	15.800	14.000	13.500	24.000	94.750
12	39.100	35.300	16.000	15.800	14.000	13.500	24.000	95.500
13	39.450	35.300	16.000	15.800	14.000	13.500	24.000	95.625
14	No Market	35.300	16.000	15.800	14.000	13.500	24.000	95.625
16	39.600	35.900	16.000	15.800	14.000	13.500	24.000	96.125
17	39.600	35.175	16.000	15.800	14.000	13.500	24.000	96.000
18	39.500	35.925	16.000	15.800	14.000	13.500	24.000	95.750
19	39.450	36.100	16.000	15.800	14.000	13.500	24.000	96.500
20	39.525	36.175	16.000	15.800	14.000	13.500	24.000	96.500
21	No Market	36.175	16.000	15.800	14.000	13.500	24.000	96.500
23	39.550	36.350	16.000	15.800	14.000	13.500	24.000	96.000
24	39.375	36.375	16.000	15.800	14.000	13.500	24.000	95.750
25	39.300	36.450	16.000	15.800	14.000	13.500	24.000	97.750
26	39.475	35.650	16.000	15.800	14.000	13.500	24.000	98.000
27	39.500	36.050	16.000	15.800	14.000	13.500	24.000	99.250
28	No Market	36.050	16.000	15.800	14.000	13.500	24.000	99.250
30	39.275	36.000	16.000	15.800	14.000	13.500	24.000	100.500
31	39.600	36.250	16.000	15.800	14.000	13.500	24.000	100.000
AVERAGES FOR MONTH								
July	40.807	36.002	16.000	15.800	14.000	13.500	24.000	96.265
AVERAGES FOR WEEK								
July								
4	45.481	36.967	16.000	15.800	14.000	13.500	24.000	94.075
11	42.750	35.750	16.000	15.800	14.000	13.500	24.000	94.958
18	39.450	35.483	16.000	15.800	14.000	13.500	24.000	95.771
25	39.440	36.271	16.000	15.800	14.000	13.500	24.000	96.500
CALENDAR WEEK AVERAGES								
July								
7	45.244	36.829	16.000	15.800	14.000	13.500	24.000	93.850
14	40.445	35.075	16.000	15.800	14.000	13.500	24.000	95.583
21	39.533	35.908	16.000	15.800	14.000	13.500	24.000	96.229
28	39.440	36.154	16.000	15.800	14.000	13.500	24.000	97.667

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

July 1956	Silver (c) New York	Silver London	Sterling Exchange "Checks"	Gold London	Gold (d) United States
2	90.250	78.750d.	279.6875	249s. 11¾d.	$35.00
3	90.250	78.750d.	279.5315	250s. 2⅛d.	35.00
4	Holiday	78.750d.	Holiday	250s. 2⅛d.	Holiday
5	90.125	78.750d.	279.4508	250s. 2¼d.	35.00
6	90.125	78.750d.	279.4531	250s. 4½d.	35.00
7	(e)	(e)	(e)	(e)	35.00
9	90.125	78.750d.	279.5937	250s. 2½d.	35.00
10	90.125	78.625d.	279.5625	250s. 2½d.	35.00
11	90.125	78.375d.	279.4776	250s. 3¾d.	35.00
12	90.125	78.375d.	279.4821	250s. 3¾d.	35.00
13	90.125	78.375d.	279.5178	250s. 4¾d.	35.00
14	(e)	(e)	(e)	(e)	35.00
16	90.125	78.375d.	279.6562	250s. 3¼d.	35.00
17	90.125	78.375d.	279.7500	250s. 2½d.	35.00
18	90.125	78.375d.	279.7500	250s. 2¼d.	35.00
19	90.125	78.375d.	279.5000	250s. 3¼d.	35.00
20	90.125	78.375d.	279.4687	250s. 4d.	35.00
21	(e)	(e)	(e)	(e)	35.00
23	90.125	78.375d.	279.4553	250s. 5¼d.	35.00
24	90.125	78.375d.	279.3214	250s. 7½d.	35.00
25	90.125	78.375d.	279.0535	250s. 8¾d.	35.00
26	90.125	78.375d.	278.9062	251s. 1½d.	35.00
27	90.125	78.375d.	278.6473	251s. 4½d.	35.00
28	(e)	(e)	(e)	(e)	35.00
30	90.125	78.500d.	278.3883	251s. 10½d.	35.00
31	90.125	78.500d.	278.3750	252s. 10d.	35.00
AVERAGES FOR MONTH					
July	90.137	78.500	279.335	—	35.00
AVERAGES FOR WEEK					
July					
4	90.250	—	279.639	—	35.00
11	90.125	—	279.508	—	35.00
18	90.125	—	279.631	—	35.00
25	90.125	—	279.360	—	35.00

Calendar Week Averages: New York Silver: July 7th, 90.188; 14th, 90.125; 21st, 90.125; 28th, 90.125.
(e) No Market (Saturday).

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.300c per pound, the average differential for delivery charges.

(b) Our export quotations for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075c for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingots; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West, and West, effective Jan. 1, 1951, commanded a premium of 1.35c per pound over the current market for Prime Western; Special High Grade 1.75c effective Dec. 1, 1955.

(f) Prime Western delivered where freight from E. St. Louis exceeds one-half cent.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 pounds.

(c) The daily silver quotation reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver .999 fine as made to Handy & Harman for nearby delivery at New York by regular suppliers in quantities sufficient to meet daily requirements, and it is usually one quarter cent below the price at which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5 per troy ounce 1000 fine effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U.S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

London Metal Exchange Quotations

	COPPER				LEAD				ZINC				TIN			
	Cash		3 Mo.		Current Month		3 Mo.		Current Month		3 Mo.		Cash		3 Mo.	
July	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked
2	265	266	269	271	111	111½	109	109½	92½	92½	90¾	91¼	735	736	729	730
3	262	264	266	267	110½	111	109	109¾	91¾	92	90½	90¾	730	731	725½	726
4	277	278	277½	278	112½	112¾	110½	111	92¼	92¾	91¼	91½	738	738½	732½	733
5	274½	275	274½	275	113¾	114	111¼	111½	92¾	93	91½	91¾	744	746	739	741
6	279	279½	279	279½	114	114½	111½	111¾	93½	93¾	91½	91¾	737½	738	732½	733
9	280	280½	280	280½	114	114¼	111½	111¾	92¾	93	91	91¼	749	751	743	744
10	280	281	279½	280	114¼	114½	112	112¼	93¼	93½	91½	92	748	749	742½	743
11	284	284½	281½	282	114½	114¾	112½	112¾	93½	93¾	92	91¼	742	743	738	738½
12	294½	295	292	293	114¾	115¼	112¾	113¼	94	94¼	92½	92¾	748	749	745	746
13	290	291	288½	289	114	114¼	112½	112¾	93¼	93½	92¼	92½	746	747	744	745
16	290	291	288	288½	114½	114¾	112¾	113	93¾	94	92¾	93	751	752	747	748
17	289	289½	287	187½	114	114¼	112¼	112½	93¾	94	92½	92¾	752	753	748	749
18	278½	279	277	277½	113¼	113½	111¾	112	93¼	93½	92½	92¾	744	745	742	743
19	284	285	283	284	113½	114	112¼	112½	93½	93¾	92½	92¾	743	745	742	743
20	284½	285	284	284½	113½	114	112½	112¾	93½	93¾	92½	92¾	748	750	747	748
23	284½	285	283½	284	113¾	114	112½	112¾	93¼	93¾	92¼	92½	745	747	744	745
24	281½	282	280½	281	113	113¼	111¾	112	92¾	93	91¾	92	742	743	740	741
25	283	283½	282½	283	112¾	113	111½	112	93	93¼	92¼	92½	756	758	754	755
26	290½	291	289	289½	112¾	113	111¾	112	93½	93¾	92½	92¾	755	756	753	754
27	290	291	289	289½	112¾	113	112	112¼	93½	94	93¼	93½	768	769	761	762
30	310	311	308	309	114¼	114½	113½	113¾	95	95¼	94¼	94¾	779	780	775	777
31	305	305½	304	304½	115¾	116	114¾	115	95½	95¾	94½	95	784	785	778	779
Av'g's	£284.761		£284.102		£113.659		£112.040		£93.483		£92.341		£749.909		£746.034	

Prices are for the official a.m. session in pounds sterling per ton of 2240 lb. Copper basis wire bars, lead 99.97%, zinc 98% and tin min. 99.75%.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments f.o.b. New York unless otherwise stated, tons of 2,000 lb unless otherwise noted. St—short ton, lt—long ton.

MISCELLANEOUS METALS

July 31, 1956

Aluminum ingot, 99 plus % lb			25.9¢
Antimony, spot, lb, less than carload, in cases			36.47¢
In bulk, carload lots, f.o.b. Laredo			35.00¢
Bismuth, ton lots, lb			$2.25
Cadmium, commercial sticks, delivered, lb			$1.70
Calcium, lb, ton lots, 98%, cast			$2.05
Chromium, 97% grade, lb, contract			$1.25
Cobalt, 97 to 99%, per lb			$2.60
Germanium, per gram, 10,000 gram lots	44½¢	@	48½¢
Indium, troy oz			$2.25
Lithium, lb, 98%	$11.00	@	$14.00
Nickel, cathodes, lb, f.o.b. Port Colborne (a)			64½¢
Magnesium, 99.8%, carloads, lb, producer's plants, Velasco, Texas, Eff. Apr. 16			33¾¢
Palladium, troy oz	$23.00	@	$24.00
Platinum (wholesale lots) troy oz	$103	@	$110
Quicksilver, flask of 76 lb. 25 flasks or more	$255	@	$257
Selenium, 99 plus %, lb. (Feb. 1)			$13.50
Silicon, minimum 97%, carloads, lb			20½¢
Tellurium, lb	$1.50	@	$1.75
Thallium, 100 lb or more, lb			$12.50
Titanium, 99.3 plus, grade A-1, max. 3% iron, lb			(b)$3.00

(a)Includes U. S. duty. (bE)ffective July 2 and July 9, 1956.

METALLIC ORES

Beryllium Ore, imported, 10% BeO, per short ton unit	$36.00	@	$38.00
Chrome Ore per long ton, f.o.b. cars Atl. ports, dry:			
44% Cr_2O_3 no ratio	$25	@	$26
48% Cr_2O_3 3 to 1 ratio	$49	@	$56
Iron Ore, Lake Superior, Lower Lake ports, long ton:			
Old Range bessemer			$11.25
Mesabi bessemer			$11.00
Mesabi, non-bessemer			$10.85
Lead (Galena), 80%, Joplin, Mo., ton			$201.32
Manganese Ore—Per long ton unit of Mn basis 48% manganese, nearby positions, subject to premiums and penalties $1.34 @ $1.40 c.i.f. U. S. ports, duty extra, nominal. Long-term contract nominal.			
Molybdenum Ore, 90%, per lb of Mo f.o.b. mines	$1.10	@	$1.15
Columbium-Tantalum, per lb, combined oxides	$1.15	@	$1.35
Tungsten Ore, per unit of WO_3:			
Foreign 60%, c.i.f. U. S. ports, duty extra	$32	@	$32.50
Domestic, scheelite, 60% f.o.b. mill (gov't price)			$55
Vanadium Ore, per lb of contained V_2O_5 f.o.b. mines			31¢
Zinc Ore, Prime, 60% concentrate, Joplin, Mo., per ton			$84.00

(a) Nominal. (b)Corrected.

METALLIC COMPOUNDS

Arsenous Oxide (arsenic trioxide) lb, in bbl carload lots delivered			5½¢
Cobalt Oxide, 72½% to 73½%, ceramic grade, per lb	$1.96	@	$1.98½
Copper Sulphate, 100 lb			(a)$15.20
Germanium Oxide, gram			27½¢
Molybdic trioxide, technical, per lb of Mo	$1.30	@	$1.33

ALLOYS

Ferrochrome 65 to 70%, per lb of Cr. (4–9% C)			26¼¢
Ferromanganese, 74 to 76%, per lb., shipg. pt.			10.75¢
Ferromolybdenum, 58 to 64% Mo, lb of Mo contained	$1.54	@	$1.66
Ferrosilicon, 50% per lb of Si f.o.b. shipping point			12½¢
Ferrotungsten, 72 to 82%, lb of W contained (eff. Feb. 1)			$3.45
Ferrovanadium, per lb of V delivered	$3.10	@	$3.40
Silicomanganese, max. 1½% carbon, lb, contracts			12¢
Spiegeleisen, per long ton, 19 @ 21% grade			$94.00

(a)Eff. July 10, 1956.

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (U. S. funds) ton:			
Crude No. 1	$1,400	@	$1,725
Crude No. 2	$750	@	$1,100
Spinning fibers	$550	@	$650
Shingle fibers	$190	@	$210
Paper stock	$114	@	$137
Waste	$82	@	$84
Shorts	$28	@	$75
Asbestos, f.o.b. ,Vancouver, B. C. (U. S. funds) :			
Spinning fiber	$460	@	750
Shingle fiber, effective Jan. 1	$205	@	$300
Asbestos, Vermont, f.o.b. Hyde Park:			
Spinning fibers	$353	@	$383
Shingle stock	$172	@	$190
Paper stock	$114	@	$145
Waste, stucco or plaster			$82
Refuse or Shorts	$39	@	$72
Barytes f.o.b. cars:			
Georgia, crude, per ton			$18
Missouri, 94% $BaSO_4$, per short ton			$16
Crude oil well grade, min. 4.3% sp gravity, st			$11.50
Bauxite, long ton, f.o.b. point of shipment:			
Domestic crude, 50 to 52% (not dried)	(a)$5.00	@	$5.50
Domestic, chemical, 55 to 58%	(a)$8.50	@	$9.05
Domestic, abrasive, 80 to 84%	(a)$18.00	@	$18.50
Imported metallurgical, per lt, fob Br. Guiana, dep. on grade	$6.00	@	$7.00
Feldspar, bulk ton:			
Potash or soda feldspar, 200 mesh, ceramic grade	$18.50	@	$22.25
Glass feldspar, white, 20 mesh	$11.75	@	$12.50
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$33	@	$35
60% effective CaF_2	$28	@	$30
Acid 97% concentrate, bulk, ton			$47.50
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00	@	$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington			$40.00
Mica—Domestic, f.o.b. mines. Punch 7¢ to 12¢ per lb according to size and quality. Sheet clear, 1½ x 2-inch, 70¢ to $1.10; 2 x 2-inch $1.10 to $1.60; 2 x 3-inch, $1.60 @ $2.10; 3 x 3-inch, $1.80 @ $2.30; 3 x 4-inch, $2.00 @ $2.60; 3 x 5-inch, $2.60 @ $3.00; 4 x 6-inch, $2.75 @ $4.00; 6 x 8-inch, $4.00 @ $8.00. Wet ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground $32.50 @ $70.00 per ton. Scrap $25 and up.			
Ocher, Georgia, ton, in sacks	$26.50	@	$30.00
Pyrites, Spanish per long ton unit of S, c.i.f. Atlantic ports			Not quoted
Sulphur, per lt, f.o.b. U. S. mines: bright			$26.50
dark			$25.50
Talc, f.o.b. works, ton:			
New York, purified	$18.50	@	$20.00
Vermont, extra white			$12.50
Tripoli, Missouri, ton:			
40-mesh, cream colored			$50.00

(a) Nominal.

IRON AND STEEL

Pig Iron, gross ton, basic, Valley Furnaces			$60
Steel f.o.b. Pittsburgh, billets, net ton			(a)$68.50
Structural shapes, Pa., Ala. etc., 100 lb	$4.40	@	$4.60

(a) Nominal.

THIS MONTH IN MINING

Texas-Zinc Builds New Mill

CONTRACT SIGNING in mid-July for Atomic Energy Commission purchase of uranium concentrates from Texas-Zinc Minerals Corp. accelerated construction of the facility at Mexican Hat, Utah. Stearns-Roger Mfg. Co., Denver contractors, started construction of the mill in June.

Texas Zinc is jointly owned by the Texas Co. and New Jersey Zinc Co. The firm had earlier negotiated the purchase of the famed Happy Jack mine in White Canyon, San Juan County from the firm of Cooper & Bronson.

New mill is scheduled for completion by Sept. 1, 1957, Texas-Zinc officials say. Payroll is expected to run between 100 and 110 employees. Company plans construction of a 70-home townsite near the mill on land leased from the Navajo Indian tribe. Facilities will include an ore-buying station, trailer court, airstrip, stores and recreation setup. Mexican Hat currently consists of a trading post and motel-cafe.

AEC says "the uranium concentrate product of the new mill will be sold to the Commission on a unit price basis."

Chief source of ore for the new mill will be the Happy Jack and other Texas-Zinc properties in the White Canyon area. But F. L. Maloit, vice president of the firm, says 20% of capacity will be reserved for custom ores from other White Canyon and Monument Valley producers.

Mill will use water from the nearby San Juan river and power from a high voltage line to be constructed by Utah Power & Light. Mill site is 126 miles from the Happy Jack via current highways, but a new road is expected which would cut the distance to 80 miles.

Extraction process to be used is still reported uncertain. Company plans first called for resin in pulp, but a solvent process is now being considered. Extraction process tests are being coordinated by Colorado School of Mines Research Foundation.

A. L. Hayes, assistant to the vice president of New Jersey Zinc Co., is project supervisor for mill construction. Kenneth Apland, now mill chief for Jersey Zinc at Austinville, Va., will be mill superintendent at Mexican Hat.

Administrative offices of the firm will be maintained at Grand Junction, Colo., with the Mexican Hat mill set up as an operating division.

Three Iron Mining Firms Option Wisconsin Lands

OPTIONS ON 4,640 ACRES of privately-owned land in Ashland and Iron counties, Wis. have been taken by Jones and Laughlin Steel Corp., Snyder Mining Co. and Ashland Mining Corp.

The J&L undertaking was launched in July after preliminary geophysical investigations which indicated possible presence of magnetic iron or taconites.

Diamond drilling program, to be completed this year, must battle 100 to 200 ft overburden. If additional results are favorable, J&L says, additional drilling will be done in 1957. Diamond drilling is being done by E. J. Longyear Co. Options run till end of 1957.

Area is considered to be the western end of Michigan's Gogebic Range by L. P. Barrett, Ishpeming, Mich. geologist. In a report to the Ashland County Board, Barrett said the Michigan portion of the Range has a very "short life."

"Within 15 years, the Wisconsin end of the area, rather than the Michigan, will be producing about 75% of all the ore that comes out of the Gogebic Range." He added that "this section of Wisconsin has a whole new future ahead in low grade ore mining."

William D. Cudlip, Detroit attorney and president of Ashland, told the Board that the 760 acres his company holds contain large amounts of taconite and that his firm is planning a pilot plant near Butternut this summer.

Snyder Mining Co. controls the remaining 2,280 acres.

Mineral Purchase Passes With Restricted Funds

CONGRESS GAVE the domestic mining industry a Government purchase program extension with one hand, and part of the money needed to operate it with the other.

The Domestic Minerals Purchase Authority, signed by President Eisenhower, calls for a 2½-year program for tungsten, asbestos, acid-grade fluorspar and columbium-tantalum. It will cost the Government about $91-million (including freight charges) through Dec. 31, 1958.

But the appropriation bill rushed through Congress in the closing days before adjournment provides only $21-million for the program. This is enough to carry it for six months, according to plan, but some observers think that on the basis of current production schedules it will last only about 4 to 5 months.

This means that industry will have to come back to Capitol Hill early next year, to ask for the rest of the money already authorized.

It was the House that cut the funds. House Appropriations Committee members knocked out the whole $91-million; the Senate Money Committeemen okayed $35-million. The Senate conferees on the bill refused to accept the House version, finally settled for the $21-million, which the House also agreed to.

Sources close to the Interior Committees in Congress think the membership of the joint Senate-House Conference Committees, made up of Appropriations Committee members, did not understand the purpose of the purchase program extension, could not understand why more tungsten purchases were being authorized when defense needs have been met and production is running double domestic consumption.

An Interior committeeman could have explained that the program is aimed at keeping domestic mines in operation and economically healthy.

Minerals purchase bill, subject to much wrangling all through the 84th Congress, finally survived a number of hearings to get passage at end of session.

Newmont Will Build Spokane Uranium Mill

WASHINGTON'S FIRST uranium mill should be under construction late this month, according to Sen. Henry M. Jackson (D-Wash), who announced that contracts for the facility would be signed during July.

Dawn Mining Co., a subsidiary of Newmont Mining Co., has optioned property near Ford, Stevens County, about 20 miles northwest of Spokane, for construction of a 400-tpd processing plant. Robert B. Fulton, Newmont, will be resident manager.

Jackson forecast that the mill would be in production by July 1, 1957, with a work force of approximately 100 men.

"The mill will give the Spokane area a completely integrated atomic program," Jackson said. "Washington State will have not only uranium mines, a processing plant, but the Hanford works—a (uranium) program no other state can duplicate; from mineral to product."

Spokane mining circles indicated that Newmont and AEC are expected to complete contract details for purchase of concentrates before the end of July.

Construction of the mill had been believed a virtual certainty following Dawn's successful bid on the four Boyd tracts, covering 459 acres of the Spokane Indian reservation. Boyd unit No. 1 is believed to contain an extension of the Midnite vein, which is being worked by Dawn under an operating agreement with its locators. Dawn is 51% owned by Newmont.

Midnite has been stockpiling ore since November in anticipation of the uranium mill. Kae H. Sowers, secretary-treasurer of the region's other major producer, Daybreak Uranium, Inc., said his firm has also been stockpiling both on the Indian reservation and at the Mount Spokane district mine, waiting for the mill. Sowers said it would save $7 to $8 per ton in transportation costs.

Ore from the Spokane area has, until now, been shipped to Salt Lake City for processing.

Inco Reported Eyeing Manitoba Nickel Plant

INDUSTRY-GOVERNMENT discussions conducted at Winnipeg, Manitoba were being watched closely by minerals producers in late July when officials of International Nickel Co. and members of the government of the province discussed Inco's current exploration and shaft-sinking project in the Mystery Lake-Moak Lake section in the northern part of the province.

H. S. Wingate, accompanied by two Inco vice presidents, R. D. Parker and J. R. Gordon, was reported by local correspondents to be discussing the cost of bringing power and rail lines to the site for a mill operation.

A shaft has been sunk beyond 1300 ft at Moak Lake and drifting and underground drilling are being carried on. Deposit is reported low grade nickel, and company officials were careful to emphasize that the project is still a long way from finalization. It is understood that, despite Inco's expenditure of more than $2-million in shaft and exploration money, more study must be devoted to the project before the big Canadian producer can commit itself. More than $25-million would be required for the power line, and a rail link would have to be constructed to the present Hudson Bay-Churchill line.

Aluminum Production In Eastern Europe

THE SOVIET UNION is said to have produced 210,000 metric tons raw aluminum in 1950 and it is believed that some 370,000 metric tons were produced in 1954. Planned capacity in 1954 was 500,000 tons, but electric shortage cut output.

Total aluminum production of the Soviet satellites in 1954 was about 70,000 metric tons. Hungary has the largest bauxite reserves in Europe, ships most of Europe's raw material. In 1954, Hungary produced 32,000 long tons aluminum and in 1955 they produced a reported 36,998 tons aluminum and 154,000 tons bauxite. Expansion plans call for 44,397 long tons aluminum by 1960.

Czechoslovakia has one plant on the Hron River, treats Hungarian bauxite. Capacity is not known.

Poland started producing aluminum in 1954 from Hungarian bauxite.

Rumania turned out 5,500 long tons in 1955, plans for 25,000 tons by 1960.

East Germany had two plants in 1945. The 60,000 ton plant at Lauta was shipped to Soviet Union and the 40,000 ton plant at Bitterfeld was also stripped and shipped out of the country. 1955 output was less than 20,000 long tons, all of it from the remains of Bitterfeld.

Daniel P. Eigo

As we went to press . . . .

Atlas Consolidated Mining and Development Corp. will build a smelter at Sangi, near Toledo on Cebu Island, P.I. Combined refining plant and smelter will produce copper from concentrates produced at the Toledo mine, according to Col. Andres Soriano, company president. Capacity is reported to be capable of handling the 10,000 tpm concentrate output which is scheduled for year-end.

Competitive leasing system for withdrawn public lands has been instituted by AEC. New setup, whereby competitive bids are called for from a mailing list at the Grand Junction operations office, became effective July 16. Names are placed on the mailing list by written request from the prospective bidder to the office.

"Extensive leasing of Commission-controlled lands," says AEC, "is not contemplated now . . . it is unlikely that many deposits included in the reserve will be offered in the near future."

Phosphate acreage bill, reported passed by the House of Representatives (see p 120), did not receive a Senate OK.

Plant expansion at Foote Mineral Co.'s Kings Mountain project between now and end-1957 will cost more than a half-million dollars, according to company president L. G. Bliss. Capacity is not expected to be materially affected; much of the money flowing to enlargement of present structures.

Ambrosia Lake area of New Mexico will be central activity center for Kermac Nuclear Fuels Corp., new firm set up by Kerr-McGee Oil Industries, Pacific Uranium Mines Co. of Los Angeles and Anderson Development Corp., Albuquerque. Three companies reportedly hold some 5-million tons of mineable ore in the area, plan negotiation with AEC for a mill contract.

Commercial magnesium production will get a 15% boost when Brooks and Perkins follows through with plans for a $7-million plant near Montgomery, Ala. Target date is 1957. Project is a joint effort of Brooks and Perkins and Dominion Magnesium Ltd., Toronto. Stated annual production capacity for high-purity magnesium is 10,000 tons according to E. Howard Perkins, chairman of the board.

Lithium Corporation of America announced completion "of the first phase of its expansion program for the production of lithium metal and its derivatives for use in the field of high energy chemical fuels" in late July. Further expansion is planned.

Intermountain area's mill and refinery programs moved into high gear with Administration's approval of the new tungsten purchase bill. Refinery at Salt Lake, concentrator at Glen, Mont. and mines at Glen and around Delta, Utah, are all resuming full production.

Behind the By-Lines...

G. P. Lutjen

As our cover indicates, we are pretty excited this month about Dr. E. W. Inett's article on rotary-percussive drilling. The R-P machine represents a real advance in drilling technology—one of the most important since the pneumatic drill made a hobby out of single jacking. Besides the very practical benefit to the operator, like drilling speeds of up to 35 ft per minute in granite, the R-P machine must provide a great deal of satisfaction to the proponents of basic research. For it was by getting down to fundamentals of how a rock drill drills that this machine was developed. Mine foreman or philosopher, all the details on rotary percussive drilling await you on p 75.

We encountered a little difficulty in putting out the second of E&MJ's International Mining Series (see p 86). It seems that in Yugoslavia every town with any social standing whatsoever has at least three different names, depending on what map you read. A compromise map was finally put together by some extremely careful guesswork. We did our best, so don't go writing to us if we selected the wrong name for your favorite spa.

Despite this minor obstacle, the Yugoslavian mining roundup makes interesting reading, thanks to Authors Marusic and Kersnic and to Tad Ullmann, Eimco Corp.'s export manager, who graciously acted as a one-man advisory committee for the whole project.

The Yugoslavian mining industry which was pretty thoroughly knocked out by World War II, has come a long way back on the road to recovery. A large share of the credit goes to a handful of Yugoslavian engineers. Among the obstacles they have overcome was the intense national desire to modernize all industry almost overnight, so that money and manpower were stretched dangerously thin. Yugoslavian mining men generously give credit to American equipment for the role it has played in the arduous rehabilitation. There is still a long way to go, but accomplishments to date clearly show that establishment of a completely revived, vigorous mining industry is only a matter of time. If we weren't plum out of slivovitz, we'd dash right out and toast the whole crowd.

A noted mining man was once quoted as saying he wasn't interested in acquiring a property that couldn't stand a lot of mismanagement. Unfortunately, properties like that are getting scarcer and most mines today need all the good management they can get. Nowhere is this clearer than in the case of small mines, where the caliber of management can be the difference between a nice comfortable living for all hands and a big, empty, heartbreaking hole in the ground. On p 91, D. A. Hall and G. I. Barnett, owner-operators of the Castor Mining Co. at San Luis Obispo, Calif., offer some valuable pointers on the profitable management of small mines. Please read the article carefully. We don't say it will improve the grade of your ore but it will certainly help keep the sheriff from your door.

Thanks to alert readers, our man in charge of More-Effective-Signs-For-Plant-and-Office has added two more decorative and stirring messages to his collection. The first was spotted on the wall of a purchasing agent in Peoria.

LET'S GET DOWN TO BUSINESS
UNLESS YOU'VE GOT ANOTHER GOOD STORY

The second was found in the engineering office of a large mining company which, for the comfort of the stockholders, shall remain nameless.

DO IT TOMORROW!
YOU'VE MADE ENOUGH MISTAKES TODAY

Well we've reached that time of the year when the weed-plagued gardener throws in the trowel, the local ball club fires the manager and the Aluminum Association announces a new production record. Our latest communique in the latter department states, "Figures released today by Donald M. White, secretary of the Aluminum Association, showed that total primary aluminum output of 1,720,607,779 lb for the first half of 1956, establishing a new production high."

We feel we ought to warn you about that figure if you're planning to base any calculations on it. Chances are it has been rounded off to the nearest pound. The whole thing could be off 4 or 5 ounces in either direction. It's a crying shame but that's the way those aluminum people are—pretty loose with figures. Matter of fact, it's high time we hair-splitters get together and demand that aluminum production be published in ounces. And the Aluminum Association would do well to start with this 1956 figure. Is it 27,529,724,460 oz, or 27,529,724,468 oz, or somewhere in between? Let's stamp out this vagueness now!

Our Eighth Ave. agent just reported some bop talk he overheard at an orange juice stand. We only pass it along to illustrate the scale that the younger generation is operating on these days.

"Man, I gotta go out to Los Angeles next week."
"Don't go, man. Send for it!"

Next month, E&MJ will bring you a most significant and unusual article. As you know, the State Government of Louisiana recently launched an all-out campaign to raise taxes. A main objective was tripling the severance tax on sulphur. Freeport Sulphur Co., the chief sulphur operator in the state, locked horns with Gov. Long's administration and won a close decision in a tough fight. It's apparent that mining companies in more than one state may one day face a similar struggle. So, as a measure in the common defense, we will publish in September, with Freeport's generous consent, the full story of how one company won at least the first round against substantial odds.

Rotary-Percussive Drill Studies Explain New Drilling Technique

E. W. INETT, PH.D.

NEARLY ALL present day rock drilling is accomplished by one of two methods—percussive or rotary. Until comparatively recently, the percussive system was confined almost exclusively to "hard" rock and the rotary to coal and other "softer" strata. Extensive research into both methods has led to a full understanding of the mechanism of each and consequently has widened the spheres of application of each system. However, such research has also led to an appreciation of the limitations of the respective systems. In short, neither system has the capacity to drill hard rock types at high penetration rates without the provision of high power-inputs, high applied thrusts and considerable cutting edge wear. More particularly this latter aspect has led to the failure of rotary drilling in hard rock.

A study of main conclusions drawn from investigations in pure rotary and pure percussive drilling reveals many common factors — especially limitations. It is possible to show that a combination of the two systems in the form of a continuous rotary motion with percussion superimposed offers the best of both systems and eliminates many of the common limitations. Thus rotary-percussive drilling will enable the harder carboniferous strata to be drilled at rates comparable with those already achieved by rotary methods in the softer carboniferous sandstones.

To appreciate the design and principle underlying the combined system, it is first necessary to refer to limitations of existing percussive and rotary systems.

Percussive Drilling

Design of the percussive drill is well known; chuck rotation is integral with piston travel. The rotation mechanism is a ratchet and twist bar so designed that the piston has a straight forward-travel during the working stroke. Immediately the return stroke begins, pawls engage and the piston must rotate as it moves back. Rotary motion of the piston is transmitted by splines (in its forward end) to the chuck and thence to the drill steel.

Any drill operator realizes that to obtain maximum penetration rate at a given air pressure he must maintain a balance between the recoil at impact and the degree of thrust he applies to the drill. This is well illustrated by Fig. 1 (Cheetham and Inett, 1953) which shows the variation of penetration rate with applied thrust, air pressure being constant. This curve is divided into three sections, each representing conditions defined by the thrust applied.

Thrust is Prime Factor

Low thrusts give rise to low penetration rates, and there is excessive "chatter" of the drill and steel. Thus the over-all contact time between the cutting edges and the rock face is extremely short. More blows may be delivered to the steel while it is out of contact with the rock than when it is actually in contact and doing useful work. Furthermore rotational speeds are high and the angular distance travelled by the bit in penetrating any given distance into the rock is considerable. In consequence the cutting edges are subjected to severe abrasive wear and there is excessive gage loss.

Medium or balanced thrusts lead to maximum penetration rates. Drill steel chatter has been reduced and the cutting edges are in contact with the rock face when every blow is delivered. Thus maximum benefit is obtained from each blow. Rotational speeds are lower, so reducing both abrasive wear and gage loss and permitting cutting edges to bite into the rock with a smaller angular displacement between successive blows.

Excessive thrusts cause a reduction in penetration rates. The main effect of this phase is that rotation becomes increasingly difficult; rotation is soon eliminated and the drill stalls.

Cheetham and Inett indicate that the reasons for these phases are as follows. At any given air pressure, the *potential* energy output from the piston head is substantially constant. Under this condition, is it the applied thrust which is the controlling factor in determining the actual energy output and utilization of that energy. Among other factors energy output is dependent upon the impact velocity of the piston; in turn, this is dependent upon the nominal piston stroke. But the machine is not always operating at nominal stroke and the extent to which the stroke varies is dependent upon the applied thrust.

In all percussive drills, the nominal stroke is that executed by the piston before it strikes the shank, assuming that the shank is in the correct position to receive the blow. However, due to insufficient thrust, should the shank not be in the correct position when the blow is delivered, the piston will overstroke in excess of the nominal stroke by an amount limited only by the degree of air cushioning and the position of the chuck rear face.

Cheetham and Inett show that increase in the applied thrust tends to reduce overstroking progressively until it is completely eliminated. Further increase in applied thrust will then reduce the nominal working stroke. This effect is readily explained. An increase in applied thrust increases the resistance to rotation since the rebound of the drill steel is limited and the contact between the bit and the rock exerts a resisting torque upon the rotation mechanism. Since at any one working pressure, the potential ability of the piston to effect rotation is limited, the return (or rotating) stroke of the piston is progressively reduced in length as this limited potential is more rapidly used to overcome the rotational resistance induced by increasing applied thrust. Thus a position is reached when the resistance to rotation is so high that the piston is unable to move and, in consequence, the machine stalls.

Independent Rotation Is Best

In essence, therefore, rotation must be maintained. Drill steel rotation can be shown to the sum total of two component parts, one being the rotation due to the inertia of the rotation parts

• This article is based upon a paper prepared by Dr. Inett for the Annual Drilling Symposium of the Department of Mines and Metallurgy, University of Minnesota, October 1955.

Applied Thrust—Key to Drilling Speed

FIG. 1 HOW INSUFFICIENT THRUST AND EXCESSIVE THRUST AFFECT ROCK PENETRATION RATE

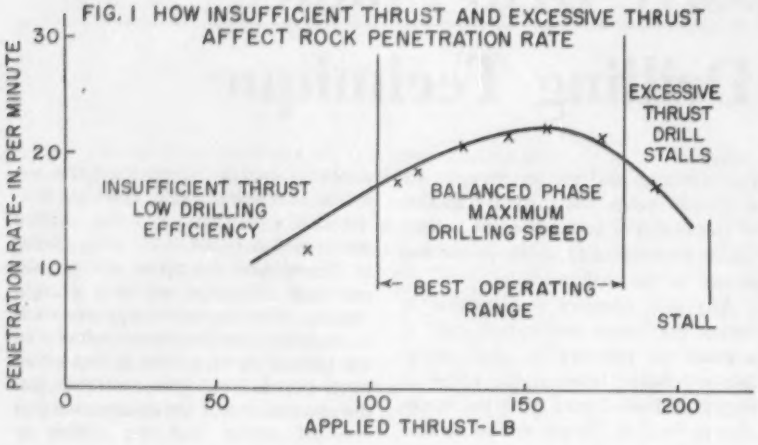


FIG. 2 HOW INCREASE IN APPLIED THRUST SLOWS DOWN ROTATION

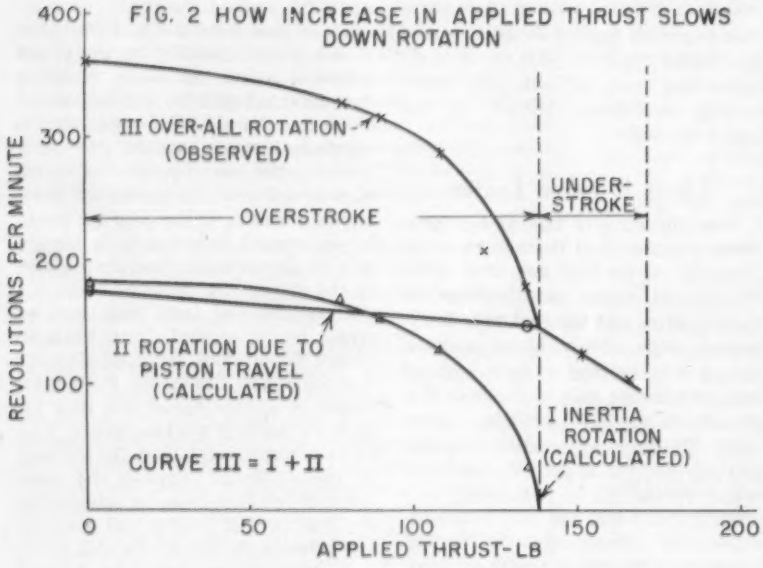
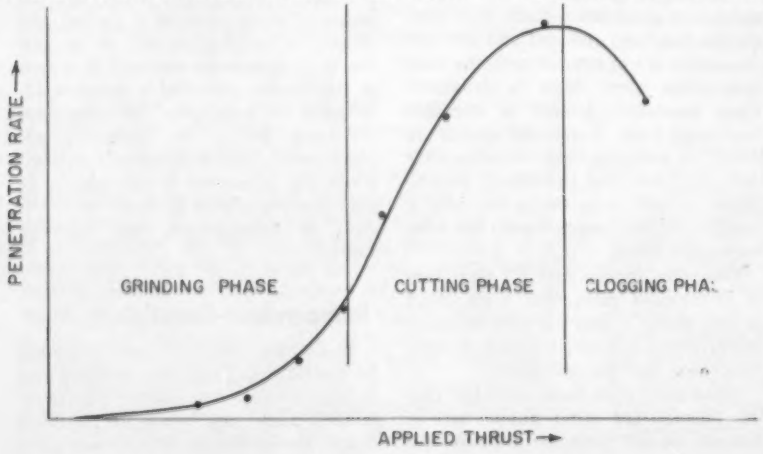


FIG.3 HOW APPLIED THRUST AFFECTS PENETRATION RATE



and the other being the rotation due to piston stroke alone. Fig 2 shows the effect of the applied thrust on the over-all assembly and each of the component rotations. It is certain that peak speeds are reached when the greater part of the inertia-rotation has been eliminated, i.e. there is just enough resilience in the system to enable rotation to be effected without the resisting torque affecting piston travel.

To summarize, Cheetham and Inett claim that . . . "If full working strokes and rigid positive control of rotation are to be achieved, then the mechanism producing rotation should not derive its energy from the piston and must not impede piston operation. These conditions can only be satisfied by a machine having independent and variable rotation. In a machine of this type each blow could, under satisfactory thrust conditions, contribute its full effect."

Rotary Drilling

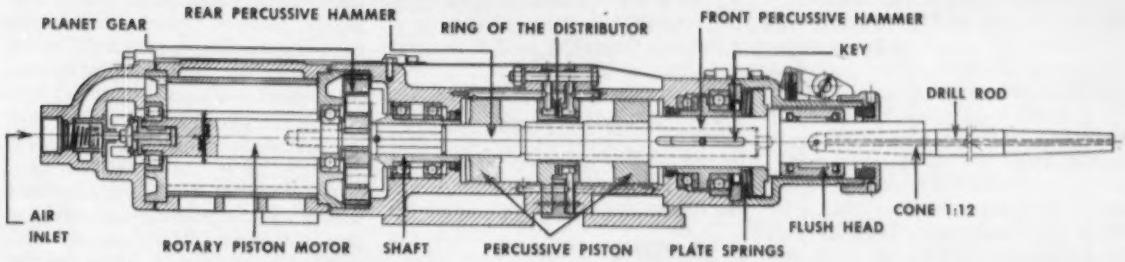
The operation of a rotary drill is not nearly as complex as that of a percussive drill. A relatively high powered motor provides the necessary shearing force and the thrust, again externally applied, provides the pressure force necessary to keep the bit edges well up to the rock face.

As in percussive drilling, thrust is the all important factor governing penetration rate. This is clearly shown by Fig 3 and the shape of this curve appears to be characteristic of most rotary drill bits in Carboniferous sandstones and shales. Many workers have produced more or less the same curves which, (as in percussive drilling) lend themselves for division into three characteristic sections.

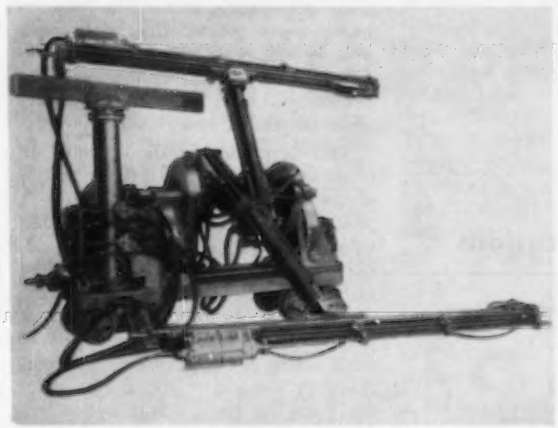
At low thrusts the penetration rate is low but improves at an increasing rate as more thrust is applied. During this phase, the cutting edges appear to be bouncing over the surface of the rock and, in consequence, should be avoided since it is inevitably accompanied by severe abrasive wear.

Medium thrusts lead to a considerable improvement in both penetration rate and bit wear. Obviously this phase is the ideal working phase.

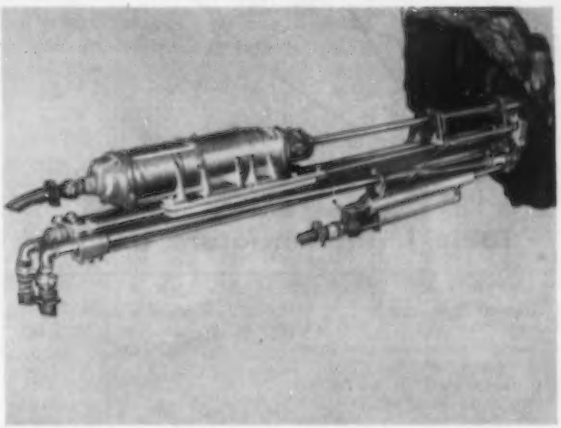
At higher thrust, the performance deteriorates and a thrust is reached beyond which the penetration rate actually decreases. Further increase in thrust stalls the drill. This condition should be avoided and is due almost entirely to the accumulation of cuttings at the bit tips increasing the resisting torque to unsurmountable levels. Thus a rotary drill will stall at high thrusts for very different reasons to those associated with percussive



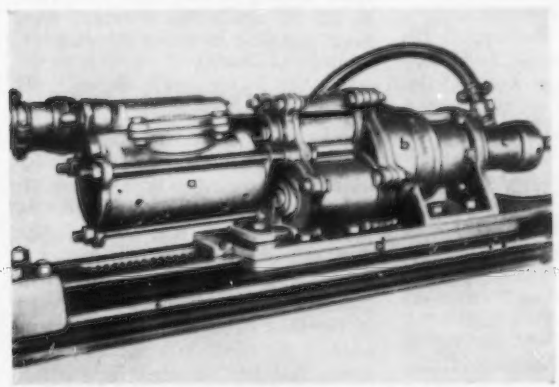
NEW ROTARY PERCUSSIVE DRILL is reported to drill about five times as fast as 45-lb percussive hammer drill. Drill is made by Hausherr in Germany. Unit delivers 6,000 blows per min at 180 to 200 rpm. Weight, 255 lb.



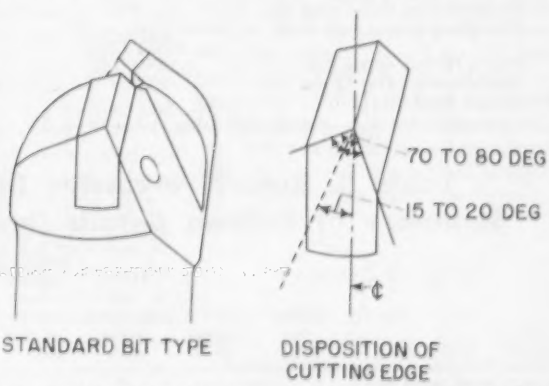
DRILLS on this jumbo develop ¾ to 1½-ton screw-feed pressure. Photo, courtesy Nykerk Corp., New York, N. Y.



EXTERIOR VIEW of the Hausherr drill shown above. Drill will use either air or water flush. Courtesy Nykerk Corp.



TYPICAL machine nomenclature and technical data on three machines is given in Table I p. 78; performance in Table II.



ROTARY PERCUSSIVE bits perform entirely new tasks, and design of cutting adge requires much careful study.

Rotary-Percussive Drilling Calls for New Design

Rotary-percussive drilling was tried in Great Britain as early as 1922, but successful development of the unit failed. Recently, German manufacturers devised successful machines in the Ruhr coalfields. Several hundred of the machines are now in use. Several designs of drills and jumbos are shown above. The problem of applying large thrusts, high rotating speeds, plus a percussive action calls for ingenuity in designs of drills and jumbos.

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drilling—rotation rather than stroke.

National Coal Board workers have termed this latter phase the "clogging phase," and it occurs when drillings are produced so fast that it is difficult to depose them from the cutting edges. Winder and Withers claim that the accumulated cuttings surrounding the bit tend to carry some of the thrust applied to the bit when, in effect, the whole of the thrust is not applied to the cutting edges. The falling off in the penetration rate/applied thrust curve is attributed to this cause. Clogging also causes friction between the bit and the side of the hole, thus increasing the torque required to effect rotation; clogging will eventually in-

FIG. 4 HOW ROTARY-PERCUSSIVE DRILLING COMPARES WITH ROTARY AND PERCUSSIVE DRILLING AT VARIOUS APPLIED THRUSTS

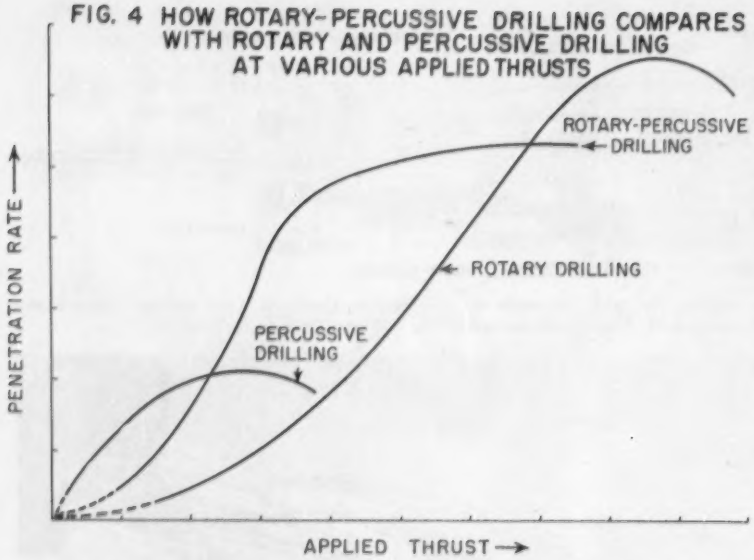

Table I. Nomenclature and Specifications

Machine	A	B	C
a* Piston chamber	Two pistons, each producing	One piston	One piston
a* Piston blow rate per min	2,500–3,000	3,400	3,400
Intensity of blow ft-lb	25	36	36
b* Compressed air motor hp	7	7	8
Rotation rate rpm	180	hard rock 100 medium rock 200 soft rock 350	180
c* External water feed			
d* Travelling base plate			
e* Power driven screw feed hp	3	2.5	—
Providing thrusts up to lb	3,000 (older model provided 7,500)	2,750	4,000
Usual thrust setting lb	1,250–2,500		1,700
Withdrawal rates ft per min	35	25–28	28
f* Airline feed motor			

*Letters match components shown in photo lower left p. 77.

Table II. Rotary-Percussive Drilling Summary of Drilling Details (Inett 1954)

Machine	Rock type	Holes per drill	Feet per drill	Overall drilling time min	Drilling speed over cycle in. per min	Actual drill time min	Actual penetration rate in. per min
A.	Very hard sandstone	48	396	200	24	104	46
A.	Sandstone	40	330	150	26	70	57
B.	Very hard sandstone	40	330	180	22	100	40
C.	Very hard sandstone	25	208	120	21	70	36

Table III. Comparison of Maximum Speeds Observed in Varying Rock Types

Rock type	Drilling system	Drilling speed over cycle in. per min	Actual penetration rate in. per min
Sandshale	Percussive (airleg)	7.3	11.0
	Rotary	20.8	60.0
	Rotary-percussive	—	—
Sandstone	Percussive (airleg)	4.9	6.1
	Rotary	—	—
	Rotary-percussive	26.4	57.0
Very hard sandstone	Percussive (airleg)	—	—
	Rotary	13.2	20.6
	Rotary-percussive	24.0	46.1

duce stalling conditions. Of course, higher powered rotary mechanisms can resist the clogging stages for longer periods, i.e. can work at higher thrusts, than lighter machines.

At first sight, it would appear that the limitations of rotary drilling could be overcome by the application of a higher powered rotary motor combined with a higher flushing capacity for clearing debris. Unfortunately the problem is not as clear cut as this for there is the serious question of bit wear which is associated with high (and low) penetration rates. The wear is many times greater than that experienced with percussive drilling and induces a very rapid deterioration of penetration rate over comparatively small lengths of hole.

This edge deterioration results in increased difficulty in drilling and is severe at both low and high values of penetration per revolution. In the first case it is predominantly abrasive, i.e. the forces involved are small but the distance travelled in contact with the rock is large. At high penetrations per revolution the deterioration is due to overloading of the cutting edges, especially in the harder rocks, and takes the form of impact fractures (chipping). In the harder rocks to which rotary drilling has been more specifically applied of late, even the thrusts in the so called "ideal range" have been sufficient to cause chipping.

Rotary-Percussive Drilling

It is now clear that the applied thrust is the dominant control characteristic with regard to high drilling efficiency. At the instant of impact in percussive drilling, it is not a significant aid to penetration but rather is a method of ensuring the maximum transfer of energy from the piston head to the drill steel. In the pure rotary method the thrust is a means of ensuring that the bit edges do the job of shearing the rock away. In the new system the applied thrust satisfies both these conditions and, as such, is claimed to inherit many of the respective advantages.

Thus rotary-percussive drilling can be described as percussive drilling in which the bit is continuously rotated against the rock face under the influence of a high thrust; or alternatively as rotary drilling where the high thrusts so necessary for high penetration rates are obtained by the frequent application of impulses. Whichever of these two descriptions appeals most, the effect is the same and the drilling action is such that there is not only the indentation in the rock caused by the percussive action, but also the mark

of the subsequent rotary cutting action.

The thrust application is critical and, indeed, must be limited to the most favorable level which varies with rock type. The thrust must be sufficiently high to prevent free and spasmodic displacement of the drill bit (phase I—percussive drilling) but it must not be so great that it maintains the edges in the indentation produced by the impulse. The thrust must permit the cutting edges to slide out of the indentation of each blow. Thus thrust levels need not reach the heights characteristic of rotary drilling.

Such is the principle behind the German combined percussive and rotary drilling system. It is not new; it was used in Great Britain as long ago as 1922 but was not developed because of contemporary technical difficulties. Figure 4 compares the penetration rate-applied thrust relationships of the three systems.

At the present time there are at least three German firms with well-tried products on the market and there are over 200 machines currently in use in the Ruhr coalfield alone. See illustration lower left page 77 for a model which is typical of the design of these machines. Principal components are lettered and named in Table I p. 78.

To some extent these drill designs have overcome many of the limitations of conventional drill types. It has been shown that the follow-factors are inherent advantages of rotary-percussive drilling rather than very significant limitations of the individual systems.

Advantages of R-P

1. Rotation is not tied to piston travel; it is provided by a separately powered unit.

2. Piston stroke can be fixed with the knowledge that each blow will be delivered from full stroke. Blow energies can be accurately rated.

3. The drill steel is always in he correct position to receive the blow since the shank will always be in contact with the chuck face.

4. A highly rated rotary mechanism is available providing a readily adjustable range of rotation values.

5. A motor distinct from the rotary motor provides the high thrusts so necessary for high penetration rates.

6. Due to the cutting action, the thrusts peculiar to the combined system must not be as high as those of the rotary system alone; bit wear is reduced.

However, it is obvious from the very different standards set by each of specified machines that there are still many unknown quantities in rotary-percussion drilling. Such factors as strength of blow, frequency of blow in relation to rotational speed, thrust, etc., are currently receiving attention both in Great Britain and in Germany. For the moment "clogging" has disappeared from the scene, but it is almost certain that it will again become apparent as very high penetration rates are attained.

The manufacturers of the drill illustrated lower left, p. 78 claim drilling speeds of up to 35 in. per minute in granite, 47 in. per minute in hard sandstone, 67 in. per minute in medium hard sandstone and 86 in. per minute in sandy shale. The accompanying tables represent summaries of data collected in the Ruhr coalfield. Table II shows the penetration rates actually achieved by the rotary-percussive drills under working conditions and Table III compares the system with conventional drilling methods in varying rock types.

It is to be expected that even more striking differences will be attained as and when a proper understanding of the previously mentioned factors is achieved.

Drill Steel and Bits

Some brief word is necessary regarding the associated drill steels and bits. Experience has shown that an anvil block located between the piston and the steel (the anvil block usually passes through the air motor and transmits the rotary motion to the steel) enables the drill steels to last almost indefinitely. (Otto and Kinna, 1953, suggest 10,000 meters as an average figure.) However, a 10-15% reduction in penetration rate can be expected. Direct impact between the piston and the drill steel is said to reduce the drilling life of steels from the quoted average of 10,000 meters to 600 meters only.

The bits used with the initial rotary-percusive machines were conventional rotary bits, but, as might be expected, they were not generally satisfactory—they were too weak. However, while bits in current use are still similar in appearance to rotary bits, in design they are really a compromise between both rotary and percussive bits. Figure p. 77 shows that they are of a more robust construction that rotary bits—indeed they must have the strength of percussive bits—and whilst they show a greater clearance space than conventional chisel bits, they again have less clearance than rotary bits.

The actual disposition of the cutting edge has been the subject of much study. For instance, a percussive cutting edge is merely called upon to fracture segments of rock and drill design tries to ensure that at the moment of impact rotation is halted. A symmetrical wedge edge is considered adequate to do this. On the other hand, a rotary cutting edge is expected to shave a comparatively uniform depth of rock from the base of the hole, but it is not expected to fracture the rock by an instantaneous penetration. Thus at the instant of impact the rotary-percussive bit is known to penetrate rock at some angle between the perpendicular approach of the percussive bit and the horizontal attack of the rotary bit. During the period between blows, the bit must penetrate as a pure rotary bit. To facilitate these actions, the cutting edge is but 70 to 80 deg only and is set asymmetrically to the center line of the bit. The bisector of the cutting wedge forms an angle of 15 to 20 deg to the bit axis.

Although various bit shapes have been developed, that shown on page 78 represents the standard form of present day bits. It has proved itself a most reliable bit for use in all types of rock.

As with conventional bits, bit wear varies very considerably with rock type, general figures being about 30 ft per regrind in very hard sandstone, 80 ft per regrind in sandstone and about 300 to 350 ft in sandy shale. Whilst these figures represent a considerable increase in drilling life over rotary bits, they are very similar to percussive cutting figures. However, bit wear can be said to lie between the two extremes of rotary and percussive drilling, but with a tendency towards percussive drilling values in comparable rock types.

Acknowledgments

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Any opinions expressed are the author's and do not necessarily reflect any official viewpoints.

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Otto R. and Kinna W. "Mechanical stresses on drill rods during percussive drilling." Gluckauf, 1953, *89*, 1221.

PHELPS-DODGE CORP. ESTIMATED their Morenci ore reserves as 450-million tons, 1.1% Cu in 1930 on 9,300 acres of mining claims. Each year they mine and move 40- to 50-million tons on a waste-to-ore stripping ratio of over 2:1.

Oxidized Copper—Part II
Who Holds the U. S. Deposits?

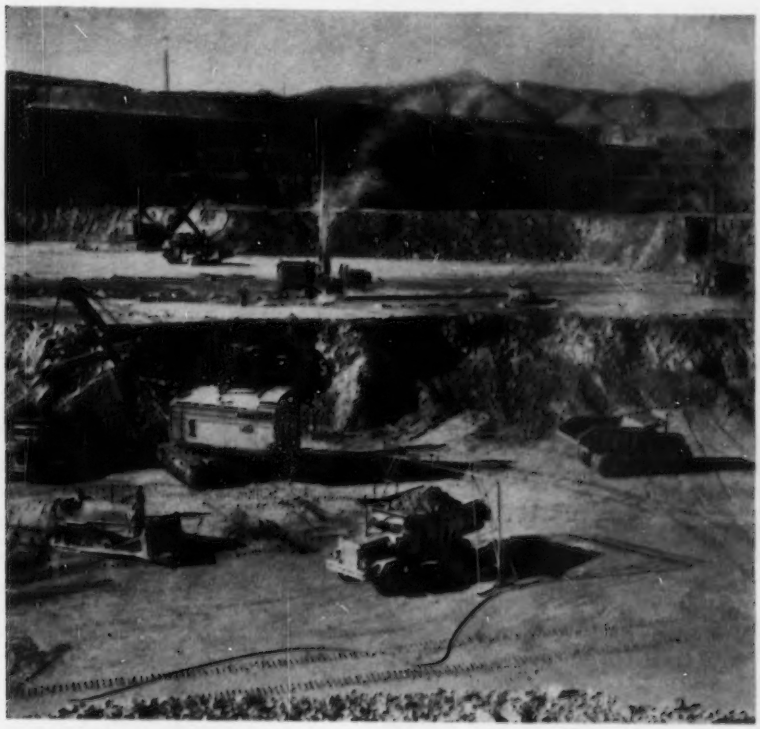
MOVING the entire townsite of Santa Rita added more than 33-million tons of ore to Kennecott at Chino. They're working on a solution to phantom oxide ore.

JAMES W. FRANKLIN
Assistant Editor

IN THE PAST many people have been worried about the U. S. position on copper, feeling that we're short on reserves. Perhaps that position is unfounded. We have over 21-million tons of metal in the known reserves of the Southwest. There are indications that substantial reserves exist in the Northwest and throughout the Middle Atlantic area. The copper producers are actively seeking new deposits in new and old areas.

It is here in the U. S. that the greatest amount of work is being done to solve the problems of oxidized copper. The future of the domestic copper mining industry may lie in its solution.

At least 300 mines, large and small, operate in the U. S. However, only three, Anaconda Co., Kennecott Copper Corp. and Phelps-Dodge Corp., mine and refine more than half of our domestic copper.



TRACKLESS MINING with diesel-powered earthmoving equipment, open-pits and leaching, are the keys to open low-grade oxide copper deposits like Yerington.

United States has Large Reserves . . .

. . . in Arizona

Ajo-New Cornelia district is the site of Phelps-Dodge Corp.'s New Cornelia open-pit. Oxide cap was worked off by 1930, according to *Copper Resources of the World*. P-D's stripping ratio is 1.5 to 1 in this low-grade sulphide orebody. Phantom oxide occurs. This deposit covers 3,700 acres of mining claims. Total ore reserves have never been published, but P-D takes about 10-million tons ore out a year.

Bagdad district covers some 38 sq miles in the mountainous region of west-central Arizona. Major producer is Bagdad Copper Co., which has an estimated 30-million tons, 0.4% oxide Cu and 30-million tons, 0.7% sulphide Cu. Bagdad produces about 13,500 tons metal a year, leaching the oxide in heaps. Flotation-sulphide recovery is about 85%. In 1953, they proposed a calcining plant to convert sulphide and oxide to sulphate and oxide. Excess sulphuric acid could be used to treat oxide ore in dump pile. They are also considering sponge-iron precipitation.

Other mines in the area are: Copper King, which shipped ore during WW II under Valerio Rossi, operator, (ore runs as high as 40% cu); Old Dick, which ran during the war and has been more or less active since; Stuckey; Mountain Spring; Kyeke; and Mammoth. Of these oxide-bearing deposits, Mammoth is the most promising, running 6,000 tons ore per foot depth. It may be very large.

Bisbee district is the fifth largest producing area in the U. S., based on past production history. Reserve picture is hard to spot, as the ore runs in veins and replacement masses; and unlike Butte does not appear to have a depth ratio.

Phelps-Dodge Corp. operates Lavender pit in Bisbee East, with reserves estimated at 34-million tons, 0.4% leachable Cu and 40-million tons, 1.14% sulphide Cu. P-D opened this pit with a Government floor price of 22c a lb; plus an escalator clause. Their precipitation plant went on-stream last year.

Phelps-Dodge also runs the Copper Queen underground mine at Bisbee. Last year P-D took 546,000 tons ore out of the Queen. The fabulous Copper Queen covers some 12,600 acres of mining claims. It was lost by the original staker in the wild bet that he could out foot-race a man on horseback over a 200-yd course. By 1942 this foolish bet had cost the staker over $20-million.

Reserves have never been published at the Copper Queen.

Banner Mining district, Gila County, south of Globe, has high-lime fluxing ore in the Christmas mine. Ore runs 2.16% Cu in chalcopyrite and oxides. Ore can be floated with sulphidizing. Christmas is operated by Inspiration Consolidated Copper Co., has much more than the 300,000 tons mentioned in 1955.

U. S. Bureau of Mines drilled into several other similar orebodies in the same area. Ore runs as high as 4% Cu in some holes.

Miami-Globe district covers a 15-mile zone from Castle Dome to Globe, and from Miami to Copper Cities. Mineralization is discontinuous. but tonnage present is large.

Inspiration Consolidated Copper Co. at Inspiration has 500,000 tons metal in the open-pit. They leach oxide and precipitate by electrolysis. Ore runs 0.4% oxide and 0.6% sulphide Cu. Inspiration will soon have their 16,000-ton leach-precipitation-flotation plant running. This has raised their production and total recovery considerably. It actually added some 350-million lb metal to reserve total above.

Inspiration produces leach ore, slimes, direct smelter ore and leach-in-place-ore from underground and open-pit. Thornton and Live Oaks pits have reported 771-million lb metal remaining. Ore runs 1.06% Cu with 0.8% oxide. Live Oaks-Keystone orebody has rich oxide over sulphide and is mined underground and open-pit.

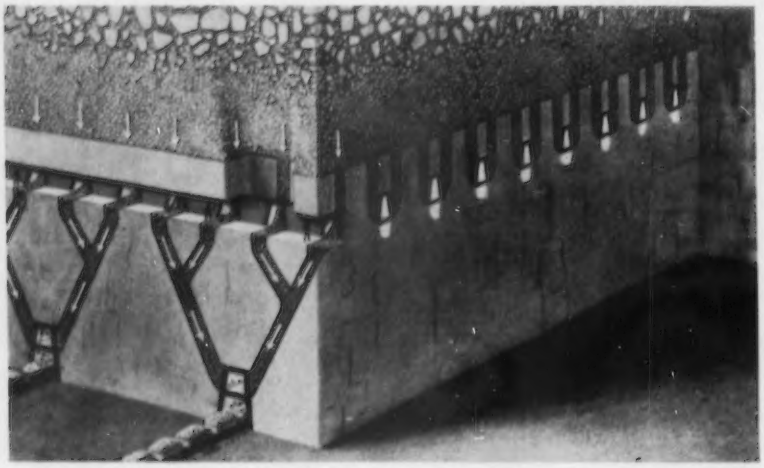
The Old Dominion mine at Globe has some oxide ore remaining.

In the Arizona Commercial, Iron Cap and Superior mines, oxide occurs and persists to 900-ft depth.

Miami Copper Co. had estimated 100,000 tons metal in place in 1952 in Miami underground. Open-pit at Miami has oxide cap. Latest reserve picture shows some 24.6-million tons, 0.7% Cu. Miami handles about 12,000 tpd ore, with leaching accounting for 15% of production. They leach old worked-out areas underground and precipitate on scrap-iron. They also use hydroxide precipitation on mine waters.

Miami extension has 23-million tons 0.5% Cu.

KENNECOTT'S SPENDING $40-million to make Ray a 70,000-ton a year metal producer, including $4.7-million to convert Hayden concentrator to a leach-precipitation-flotation mill. Sponge-iron precipitation will be used.



BLOCK CAVING puts large underground mines (this is part of Greater Butte) in competition with open pits by feeding a continuous stream of ore to the milling plant.

Castle Dome, Miami, had 9.9-million tons 0.7% Cu, and 3.6-million tons 0.5% Cu in 1950, but latest report says that it is finished. Miami moved its 12,000-tpd surface plant to Copper Cities open pit mine.

Copper Cities has 32.9-million tons 0.78% Cu, and Miami has a 23c a lb Government floor price.

Morenci-Metcalf district was once a rich, high-grade producer, but now depends on large-tonnage, low-grade ores for its entire output. Phelps-Dodge Corp.'s Morenci covers 9,300 acres of mining claims, and reserves were estimated by P-D in 1930 as 450-million tons 1.1% Cu. A 1935 report said that the oxide cap had been worked off. Here and elsewhere in the district, oxide occurs in the caps and as phantom material.

Latest stripping ratio is over 2:1. P-D floats ore, recovering sulphide and minor oxide. Based on plant expansions since the reserve estimate in 1930, it appears that Morenci's early estimate was modest, according to *Materials Survey, Copper.*

Ray-Mineral Creek district is now open-pit, except for leaching of old underground parts. Deposit is low-grade, eroded, weathered, heavily oxidized in some areas and high in copper sulphate. That's why Kennecott Copper Corp. spent $4.7-million on Hayden concentrator's leach-precipitation-flotation flowsheet. They will use sponge-iron precipitation to get 2 lb more copper per ton of ore. Expansion at Ray to get this copper and make Ray a 70,000-ton per year metal producer will cost Kennecott about $40-million.

Ray ore runs 1% Cu. Reserves are not known, but they moved some 43-million tons overburden to get at the ore in the open-pit.

San Manuel-Tiger district is the site of the recently opened San Manuel Copper Corp. property. San Manuel is a subsidiary of Magma Copper Corp. and is an underground project. Total reserves when they decided to stop drilling came to nearly 500-million tons, 0.7% Cu. Of this 500-million, about 111-million is oxide at 0.77% Cu. The rest, 367-million, is sulphide at 0.78% Cu. Oxide cap won't be disturbed for years to come.

When they hit full stride, San Manuel will turn out 30,000 tpd ore and 70,000 tons metal a year.

Also in the area: Siskon Corp. took over option on the Old Reliable copper mine and proposes to leach-in-place to recover about half of the 42-million lb copper present; and Magma Copper Corp. also owns the St. Anthony property near San Manuel. Several other copper producers have or are trying to acquire property in the area.

Pima-Helvetia Mining district has oxide mixed with chalcopyrite and chalcocite. Several mines were worked here in the past but much oxide-sulphide copper seems to remain. Re-

serves are large, with some deposits extending 200 ft deep in the oxide zone.

Pima Mining Co., owned by Utah Construction Co., Union Oil Co. and Cyprus Mines, will open-pit the Pima property. They plan to mine and mill about 3,000 tpd ore. Pima was discovered in 1952 and thought to be rich and small but now appears to be low-grade and large around the rich core (6% Cu). The oxide cap is 40 ft thick and irregular over the sulphide orebody.

Banner Mining Co. operates Mineral Hill and Daisy mines near Tucson. They float the ore to get a mixed oxide-sulphide concentrate. Last year (their first full year) they shipped 9-million lb copper in concentrates. They handle about 900 tpd ore.

Banner hit a new orebody on a drilling program last year. It's about seven miles south of their Pima property. No reserve data to date.

Lewisohn Copper Corp. has several claims that they're drilling in the area.

Jerome district was once a rich producer. The United Verde and United Verde Extension were operated by Phelps-Dodge as underground mines. Verde is worked out and the Extension has very little ore left to mine.

Superior district has one major deposit, owned by Magma Copper Corp. Reserves are 1.5-million tons, 6% Cu. The Far West vein runs 5.1% Cu. Koerner vein runs to 6.6% and North Branch vein runs 6% Cu. Magma produces some direct smelter ore.

Anaconda Co. took a 10-year option on two copper discoveries in the area near Magma. Ore is a vein-type and will have to be mined underground. Anaconda also is negotiating for two other properties in the same area.

Tucson district is famous for the Silver Bell mine of American Smelting & Refining Co. Oxide occurs, but ore is not suitable for leaching, since it is high in iron, alumina and magnesia. U. S. Bureau of Mines recommended in 1931 that Silver Bell ore be calcined before leaching. They operate the El Toro and Oxide pits. AS&R floats this ore, producing 21,000 tons metal a year. Reserves in open pits are about 32-million tons, less than 1% Cu. Government floor price is 24½c a lb, with escalator clause.

Duval Sulphur and Potash Co. is drilling the old Coronado Mines, Inc. property near Silver Bell. This consists of 10 mines on 163 unpatented claims. Some 80-million tons are reputed to be on hand.

Several other small mines are in this area.

Tyrone district is where Phelps-Dodge once leached ore from its Burro Mountain deposit. They stopped mining here in 1949. An extensive and promising drilling program is underway. Reserves were once estimated at 100-million tons of less than 1% Cu.

Troy has an old copper mine, the Troy Copper & Uranium Corp., property, where a leaching operation has been proposed.

Dundee. No mining has been attempted in this area since 1935, but oxide copper can be found to a depth of 5 ft in the pre-basaltic conglomerate.

Harshaw-Washington district. Malachite occurs in an old mine near Patagonia, Santa Cruz County.

. . . in Montana

Butte district holds the second largest vein deposit in the world. The district is at least 2.5 miles wide, 5 miles long and ¾ miles deep. Anaconda Co. has over 160-million tons, 1% Cu blocked out and may have as much as 100-million tons more possible. Some 30-million tons is oxide copper. Greater Butte runs 1% Cu, with

THIS AERIAL SHOT shows Veteran pit in foreground with Liberty in right background. Both pits are operated by Kennecott Copper Corp. Veteran, owned by Consolidated Coppermines Corp., has 20-million ton, 0.98% copper ore reserves.

BINGHAM CANYON YIELDS 30% of our domestic production under Kennecott Copper Corp.'s Utah Copper Division. Ore goes to the Arthur and Magna concentrators, each of which has a 40,000-tpd milling capacity. Mining cut-off point is 0.4% (8 lb) copper.

0.18% as oxide. They turn out 45,000 tons metal a year using sponge-iron precipitation to get the oxide. Ore comes from Skyrme pit and Kelly underground.

Most of Butte's mine water goes to the High Ore mine, where it is sent to the surface for precipitation to yield several million pounds of copper a year.

An expansion plan now going on at Greater Butte will cost Anaconda $35-million and will add some 2,500 employees to the payroll by year-end 1956. They will start sinking the Ryan shaft this year and get Berkeley pit in full swing.

. . . in Nevada

Ely-Kimberly district is about 8 miles long and a mile wide. Most of the ore is unaltered sulphide with phantom oxide. Kennecott Copper Corp. has some 20-million tons, 0.98% Cu in the Veteran pit (owned by Cons. Coppermines). Kennecott's Kimberly pit has estimated 3.5-million tons, 1% Cu. Ore is somewhat refractory. Reserves at the joint Kennecott Copper and Consolidated Coppermines Corp. Kimberly pit (Morris-Brooks pits) have been estimated at 41-million tons ore. Some 20-million tons are in the abandoned Emma mine, with more nearby.

Consolidated Coppermines sends its Kimberly ore to Kennecott's McGill concentrator. Some of the ore goes as smelter flux. Consolidated's Kimberly reserves are about 30-million tons (about ten years' supply) in the Brooks pit. They also have 16-million tons in the Tripp pit, where they mine 7,000 tpd.

Kennecott has 1- to 2-million tons, 1.1% Cu in the Hi-Minnesota, above the Deep Ruth orebody and will have it producing before year end. Minnesota will be mined so Kennecott can get at the 22.5-million tons, 1% Cu in Deep Ruth. They also operate the Liberty pit.

Yerington district holds the 35-million ton, 0.97% Cu oxide orebody owned by Anaconda Co. They use sponge-iron precipitation to recover leached copper. Mill vat-leaches about 11,000 tpd ore, produces nearly 33,000 tons cement copper a year.

The Copper Cliffs mine near Yerington has some 500,000 tons, 2.5% Cu, according to E. R. Lund, geologist, Salt Lake City.

Bunkerville, Clark County, has ore running 3 to 9% Cu, with nickel and platinum in the old Key West mine, owned by Key West Nickel & Copper Corp.

Dixie Valley has considerable oxide ore. In the Black Warrior and Black Copper mines, Pinal Mountains, ore is mostly oxide. This area is 18,500 ft long by 300 ft to 2,700 ft wide (average width is 700) and 100 to 500 ft deep. Large reserves still remained in the deposit in 1935, when last investigated.

Lander County. Copper Canyon Mining Co. plans to raise mill capacity to 500 tpd. They recently reopened an open-pit deposit last worked in 1952.

Copper Canyon. Battle Mountain Copper Co. is setting up shop and will start mining again.

. . . in Utah

Bingham Canyon district is the second largest copper-producing area in the U. S. It has oxide in upper layers of this 0.9% Cu orebody owned by Kennecott Copper's Utah Copper Division. Bingham is an open pit, producing 30% of U. S. copper. Ore goes to Magna and Arthur concentrators, each with 40,000-tpd ore capacity. About half Utah Copper's production comes from precipitates. Cut-off point is 0.4% Cu.

According to *Materials Survey, Copper,* Bingham Canyon reserves can be estimated at over 5-million tons red metal, based on smelter write-off. Probably more copper is available, but it may be tough to handle.

In the same area, American Smelting & Refining Co. did some drilling on three copper prospects on Utah State Prison property, some 18 miles south of Salt Lake City.

Moab. Paramount Mining & Development Corp. shipped its first load of high silica ore to AS&R at Garfield. Company mines 300 tpd from its 750,000-ton orebody near Moab. They plan to raise mill capacity to 550 tpd ore.

Tintic district holds considerable oxide copper reserves.

. . . in New Mexico

Chino-Santa Rita district carries native copper and oxides in caps of orebodies. Chino is operated by Kennecott as an open pit. Reserves were indicated at more than 33-million tons, 0.89% Cu, since that much more ore was made available recently by moving Santa Rita town. Ore is mostly chalcocite with phantom oxide. They are working (since 1954) on a leach-precipitation-flotation flowsheet similar to the one going in at Ray. This will recover the phantom oxide.

Near Lordsburg, Banner Mining Co. operates the Miser's Chest and Bonney mines. They produced 83,000 tons concentrate last year.

Carrizozo Corp. owns Hurlow-Bingham mine and the Surprise mine,

both located within New Mexico.

Stauber, Drunzer and Curnes mine at Santa Rose produces silica-copper flux.

The San Pedro mine is near Golden.

. . . and elsewhere

Hollister, Calif. In the Antelope mine, 36 miles southwest of Hollister, oxide ore was once leached.

The Red Belt Copper district, Southern Colorado, New Mexico and even Southwest Oklahoma, has many small, scattered and mostly low-grade deposits of mixed oxide-sulphide ore. Some direct smelter ore has come out of this area.

One company, Grants Mining & Leaching Trust, set up an ammonia-leaching plant in 1954 to test the method on this tough-to-handle-ore. No results have been announced.

Red Bed ore can't be floated successfully. Acid leaching costs are very high, due to the high iron and manganese content.

This Red Bed extends from Baca County, Colo. to Eddy County, N. M. Deposits are thin and scattered. Grades run at best 3% Cu and transportation is a big problem. One deposit was examined and still has over 800,000 tons of 2.5% Cu in one section of an underground mine, according to Geological Survey.

Navajo-Hopi Indian Reservation holds several million tons oxide copper according to E. B. Mayo, in *Mineral Resources, Vol. I, Navajo-Hopi Indian Reservations, Arizona-Utah* (1956). White Mesa area holds the most promising deposits: Little Dick, Grand Pacific, Copper World, California and the Dutchman.

Grades in the area run 0.3 to 23% Cu. Shattuck-Denn Corp. drilled the claims mentioned above (and the Mayo claim), estimated reserves in these bodies at 2.5-million tons, 0.75% Cu.

Elsewhere in White Mesa, Read, Sample and Sullwold mines have up to 2.3-million tons, ranging from 0.3 to 1% Cu.

Copper is recovered by leaching in these deposits.

Oxide occurs toward the base of the Shinarump formation in Monument Valley area, along with uranium and vanadium. It also occurs at Carrizo Mountain.

Lack of water prevented exploitation, but San Manuel, Magma Copper and some of the uranium companies are getting water out of the desert. Maybe what is needed here is not a leaching investigation, but a water supply program.

Denver, Colo., area has one malachite deposit recorded. Malachite Copper Co., Genessee Mountains, west of Denver, takes ore out from time to time.

Alder Creek - Mackay - Custer County, Idaho, has spots of oxide copper showings. Snowstorm mine in Coeur d'Alene leaches its oxide ore. Pope-Sherron mine, Lemhi Range, contains so much oxide that a chlorination mill was once tried.

Pardee, Wash., copper mines have oxide zones extending some 400 ft deep in the deposits.

Somerville-Bound Brook, N. J., has oxide and native copper in sedimentary rock. Deposits were once worked for copper in the Revolutionary War period.

Virgilina district, Virginia and North Carolina has sulphide-oxide and native copper in vein deposits scattered throughout the area.

Virginia-South Mountain-Maryland-Pennsylvania district has catoctin-type ore deposits scattered from middle-north Virginia on up to Phoenixville, Pa.

Adding Up The Score

In Part I, we said that Free World reserves were 100-million tons copper. That figure was suggested by Arthur Notman in 1935 based on known reserves and cut-off point at that time.

Counting only those deposits mentioned in this report (where grade and tonnage are stated) and ignoring the primary sulphide orebodies (except Canada), we have over 98-million tons metal recorded in this article. Add the rest of the primaries and spots where copper is recovered as secondary material and the total will go slightly over the 100-million mark. We had 100-million in 1935 and we have 100-million in 1956. Twenty years hence we should still have 100-million ton reserve—we'll just start counting lower grade material and ores like the Red Bed.

The Free World has plenty of copper and we're developing the methods to recover it.

Recently the Copper and Brass Research Association said that U. S. per capita use of copper has tripled in the last fifty years to a 17- to 19-lb per head level. Compare this to total world figure of 2.8 lb. The U. S. tripled its consumption per capita in the last fifty years and we can imagine that the rest of the world may do the same in the next 100 years. That will make demand for copper about 3 to 5 times the present level. It's nearly 3-million tons now and will be close to 3.5-million by 1960. We're developing the reserves and the methods to meet that demand.

Sources Used

Source material for this article was supplied by the McGraw-Hill World News Bureau. We are also grateful to the Canadian Department of Mines and Technical Surveys, the U. S. Bureau of Mines and the U. S. Geological Survey.

In addition, we examined the following material: *Engineering & Mining Journal* and several other reliable mining publications since 1950; reports and bulletins from various geological surveys and mining inspectors around the world; financial and annual reports from many companies; public relations literature; and the various publications which we have mentioned on previous pages.

This brings to an end the second section of this survey. Perhaps we've missed a few deposits and maybe you have some later data than we could find. If you have information, we'd like to have it to publish.

In the next section we'll look into the methods used to extract oxidized copper. Sometimes it will float. Sometimes it can be leached. In other cases a combined leach-and-float or float-and-leach will do the trick. Some oxide is low enough in alumina to go as smelter flux. Occasionally segregation works. But there are many cases where the problem hasn't been resolved. Lots of oxide goes untouched into the tailing pond. There are many ways to treat pregnant solutions. We'll get into all of these problems in the next section.

This article will be reprinted in full when the entire survey has been published. The date and time of the reprinting will be announced later in the year.

MINERALS are scattered throughout the several departments of Yugoslavia. Major operating mines are the Bor copper mine in east Serbia; the Trepca lead-zinc mine in Serbia; the Vares and Ljubija iron mines in Bosnia. All are being expanded.

Yugoslavia Seeks Mineral Development

ING. RIKARD MARUSIC
PROF. VIKTOR KERSNIC

LIKE SO MANY of her sister nations, Yugoslavia is trying to do a lot of things at once—politically, economically and industrially, she is trying to make up for time and wealth lost during and immediately after the Second World War.

The mining industry, once one of Europe's greatest, has already regained its position in most fields, and is moving on through intensive exploration, expansion and research.

In the pre-Tito days of Yugoslavia, 86% of the funds invested in mining was of foreign origin. The mines are now all publicly-owned.

The nation's resources, pending exploration now under way, are catalogued by Mr. Marusic as follows:

Surplus—Antimony, bauxite, chromium, copper, lead and zinc, and mercury.

Sufficient—Coal (but no coking coal) and iron.

Deficient—Manganese, molybdenum and oil.

Yugoslavia has received considerable foreign aid, including some from the U. S. Equipment for flotation and smelting plants are almost exclusively of U. S. manufacture. In 1950, the Export-Import Bank loaned $20-million to Yugoslavia to aid its recovery. Of that figure, $2.7-million was spent at the famous Trepca lead-zinc mine

Mr. Marusic is a member of the faculty of Zagreb University and author of a number of articles on Yugoslav mining technology and history. Prof. Kirsnic is a member of the University of Ljubljana faculty, and prepared his section of this report with the cooperation of Prof. Joze Duhovnik and Prof. Viktor Fettich. *E&MJ* is also grateful to Thaddeus S. Ullman, manager of Eimco Corp.'s export department for his invaluable aid.

Metallic Production of Yugoslavia 1939-1955 (in metric tons)

	Blister copper	Electrolytic copper	Refined lead	Zinc, crude	Antimony regulus	Al in Ingots	Quicksilver	Bismuth (kg)	Silver	Ferroalloys
1939	41,643	12,463	10,651	4,918	1,500	1,795	378	.....	1,303	12,199
1946	21,730	12,925	32,591	3,294	1,206	567	306	17,140	8,679	4,127
1947	32,350	14,078	40,402	6,499	1,390	1,263	326	42,700	35,951	8,808
1948	36,870	14,441	49,214	7,167	1,500	1,884	377	51,000	46,787	12,337
1949	34,384	14,162	56,760	9,903	1,643	2,493	441	38,100	59,650	12,040
1950	40,080	14,676	57,204	12,315	1,815	1,931	495	56,280	74,239	13,642
1951	32,011	14,004	60,068	13,223	1,229	2,828	505	87,760	94,306	14,192
1952	32,819	21,390	67,180	14,463	1,329	2,563	504	98,700	80,155	14,534
1953	31,190	27,764	70,796	14,549	1,410	2,792	492	98,452	94,804	10,605
1954	30,295	26,946	66,729	13,644	1,552	3,496	498	109,699	88,004	11,551
1955	28,260	24,837	75,612	13,767	1,605	11,499	503	104,108	.....	.....

Production of Principal Ores 1939-1955 (in metric tons)

	Iron Ore	Copper Ore	Lead-Zinc Ore	Bauxite	Manganese Ore	Chrome Ore	Antimony Ore	Pyrite Ore	Pyrites Conc.
1939	666,813	983,903	774,772	718,594	5,656	44,852	18,963	49,927	78,064
1946	398,607	645,749	617,696	70,562	7,514	77,154	30,495	48,594	94,141
1947	739,382	811,668	739,361	88,408	12,748	75,754	35,804	75,703	175,859
1948	878,493	1,049,723	850,652	143,950	13,049	62,613	34,661	90,718	209,288
1949	835,213	954,481	1,073,562	346,640	13,837	109,120	49,077	71,742	172,033
1950	730,866	1,115,779	1,186,724	206,061	13,338	114,736	80,534	30,935	86,232
1951	581,518	1,173,199	1,188,590	498,285	12,868	99,639	55,088	40,238	113,541
1952	676,010	1,264,998	1,203,764	613,439	12,687	107,222	74,594	20,732	167,397
1953	794,917	1,343,563	1,432,100	477,557	10,017	126,961	61,450	7,170	165,833
1954	1,110,743	1,298,860	1,484,522	686,689	9,206	124,480	75,238	2,171	160,109
1955	1,398,298	1,476,863	1,650,178	791,017	10,955	126,207	80,474	.....	226,682

in rehabilitation and expansion and $3.2-million at the Bor copper mine.

Coal mining is a major Yugoslav industry and is responsible for some of the rapid post-war progress. In 1955, 1,137 tons hard coal were mined; 7,682 brown coal and 6,388 tons lignite. Mining engineers and research men are devoting great effort to avert a coal shortage they all foresee in future years.

In 1955, Yugoslavia produced 1,848,900 barrels of crude oil from the fields in Slovenia and Croatia, about half of national consumption.

The following paragraphs, compiled from information collected by Prof. Kersnic and Mr. Marusic, give an excellent picture of Yugoslavia's position today, with some indication of where it will be in the future.

Lead-Zinc Expansion

Two main regions dominate Yugoslavia's lead-zinc mining industry: Serbia-Macedonia and Slovenia. Principal mine is Trepca, in south Serbia, which accounts for about 42% of national output.

The Serbia-Macedonia region is divided into three parallel zones:

1. Zletovo mine, in the easternmost zone, accounts for about 12% of production. Ore appears in veins which are tied to kaolinized andesite with quartz, and to younger intrusions of sanidine-dacite. Grade is approximately 8% Pb, 2% Zn, with some silver, bismuth, arsenic and antimony. Mining at Zletovo dates back to Roman times. Reserves were vastly increased following World War II.

2. Trepca (Stari Trg) shares output in the second zone with ore-bodies at Kiznica, Janjevo, Ajvalija, Novo Brdo, Lece (Slisane) Kapaonik (Belo Brdo), and Rudnik. All are tied to sanidine-dacite, occurring in andesite outcrops. Main deposits are of the metasomatic-type limestone of silurian and cretaceous age and of vein type, impregnated in serpentines, andesite and "flysch."

Trepca ore grade has declined steadily since operations began in 1930. Grade was originally 11% Pb, 8% Zn; it's now about 6% Pb and 5% Zn. Ore also contains silver, bismuth, arsenic, antimony and pyrite. A new 17-ft-diameter shaft has been sunk to 2700 ft. Orebody lies between with tectonic breccia and schist on one side and limestone on the other; dips 40 deg to west northwest.

Kiznica, the newly-discovered orebody, has an average grade of 3.5% lead and 1% zinc, but reserves are estimated near 5-million tons. Veins run as thick as 33 ft on contact between serpentine and flysch. Impregnations of galena and sphalerite are found in the deposit.

Kapaonik, another major orebody, about 4,000 ft above sea level represents a transition from metasomatic to vein-type deposit. Ore is richer than Trepca's, and the mine accounts for about 8% of Yugoslav production.

Ajvalija mine, like Kiznica, has higher zinc and lower lead content. Orebody appears in schists along a NW-SE fault, and includes rhodochrosite.

Novo Brdo faces transportation difficulties and oxidation in upper levels of the orebody. Samples have shown zinc as high as 11% and lead 5%, with some silver and gold. Deposit is on contact between dacite-andesite, schists and marbled limestone. Shaft opening

LEAD-ZINC CONCENTRATOR at Zvecan (Trepca) is the largest in the nation. Smelter at Zvecan has an annual capacity of 75,000 tons. Mine and plant here were rehabilitated in post-World War II, $2.7-million modernization.

is about 2300 ft above mean sea level.

Lece (7% Zn, 3% Pb) has its own flotation and cyanidation plants. Other mines in the second zone include Kosmaj Baba, Avala and Rudnik, all in northern Serbia. Ore in those mines is rich in pyrrotite and higher in galena than sphalerite, contains silver, bismuth and arsenic.

3. Veliki Majdan and Srebrenica-sase dominate the third zone, though prospecting on other orebodies looks promising. Veliki Majdan (9% Pb, 4% Zn, 40% pyrite and some silver) is composed of small deposits in and along a contact of limestone, with schists and dacite. Rich veins (25% Pb, 7% Zn) at Srebrenica-Sase which were not completely mined by the Romans are still providing ore, often run as thick as 17 ft.

Two other types of orebodies, probably the oldest in Yugoslavia, are found in Montenegro; at Stuplja Stijena and Brskovo, to the south. Both are tied to Triassic porphyrites and keratophyres. Suplja Stijena is being mined at the present, showing about 12% Zn and 6% Pb, with some chalcopyrite.

Slovenia region's major mine is at Mezica, a metasomatic-type formation in lenses of limestone, veins and faults. Ore contains galena and sphalerite, some wulfenite ($PbMoO_4$). Here, too, ore grade is dropping steadily, from 12% lead and 4.5% zinc in 1930 to 4% and 2% at present. Not long ago, Mezica began treating dumps containing 1% zinc and 3% lead.

The orebody is believed to syngenitic, originating from volcanic emanations. Earlier opinions held that the deposit belonged to the Tertiary.

Eight flotation plants handle Yugoslavia's lead-zinc ores: Trepca, with 3,000 tpd capacity; Mezica 1,000; Zletovo 1,000; Rudnick 500; Lece, Novo Brdo and Suplja Stijena, 250 each; and Veliki Majdan 100 tpd. The latter five plants were put into production in 1952 and 1953; the three older mills have been remodeled and expanded since World War II—in 1939, Trepca had only 2,000 tpd capacity. New mills use Denvers, Fagergrens.

Ore dressing at Mezica includes Wemco HMS machine using ferrosilicon, with a Mobil-Mill (80 tph) ahead for scalping.

All zinc ores are refined at the Celje smelter, which produced 13,767 tons in 1955. A new, 12-000-ton plant at Sabac will produce electrolytic zinc, cadmium and sulphuric acid.

Lead smelters are at Zvecan (Trepca) and Mezica, with annual capacities of 75,000- and 15,000 tons respectively. Equipment includes Newnam furnaces, blast furnaces and a Dwight-Lloyd roasting plant. New electrolytic plant reclaims silver. Domestic consumption of lead and zinc is approximately 8,000 and 10,000 per year. The two metals (and their concentrates) account for some 15% of export income per year.

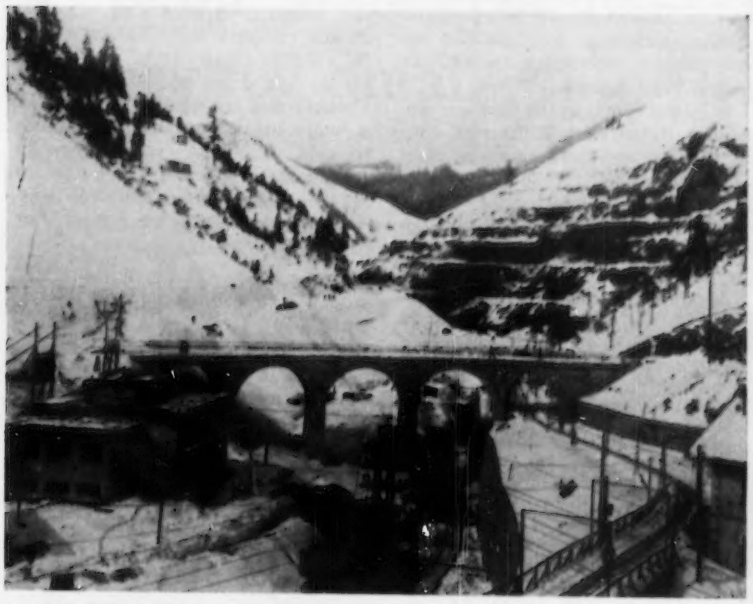
Total reserves of lead-zinc ores in Yugoslavia are now estimated at 18-million tons, with the central group (Trepca, Kapaonik, etc.) contributing some 15-million.

Bor is Copper

In its history to date, Bor has produced some 23-million tons of ore and 970,000 tons copper. Even mining from 1905, reserves are still set at 45-million tons of 1.67% Cu, which should provide some 600,000 tons copper for future needs.

The orebody is located in the east Serbian massif, in which appear younger intrusions of monzonite-granodiorite. Ore is rich in pyrite, including chalcopyrite, covellite and bornite. Gangue is represented mainly by quartz, with some barite, carbonates and zeolites.

Mining methods at Bor consisted of horizontal cut-and-fill until 1952. But, with lower grade appearing at depth (from 3.88% Cu in 1950 to 2.50 in 1955) the mine converted to sublevel open stoping. With the change in method, output is expected to hit 1.8-million tons per year. Along with the revised mining plans, Bor is constructing a new hoisting shaft and enlarging the flotation plant to handle 4,000 tpd, a 100% increase. Future plans see an increase to 7,000 tpd.



IRON MINE at Vares is Yugoslavia's major deposit. The syngenetic orebody contains about 77% siderite, 18% hematite and 5% limonite and is high in manganese.

Flotation of the lower-grade requires a switch from one-stage flotation to a rougher-scavenger flowsheet before floating and two-stage cleaning following. Float concentrates are agglomerated first in Savelsburg pots. High grade goes directly to water-jacketed furnaces for smelting.

Pyrite flotation concentrates contain about 45% S. Smelting, pre-refining and electrolytic refining all take place at the site, as does recovery of gold, silver and selenium. Cyanidation plant with Dorr machines treats the gold-bearing quartz.

Target date for the expansion at Bor is late 1956 or early 1957. Because of the steadily lowering grade, annual output of blister (30,000 tons) will remain unchanged despite increased ore tonnage.

Domestic demand for copper is about 43,000 tons per year. The difference between Bor's production and national demand is expected to be more than covered with the new government plan for the much-discussed Majdanpek deposit about 40 miles north, which is estimated to have reserves of 130-million tons of 0.85% Cu.

Until 1954 Majdanpek was a pyrite operation, producing 2,000 tons per year. With development of the "disseminated" copper deposits, which are impregnated with chalcopyrite, pyrite, bornite and chalcosite, found after World War II, it will be worked as an open pit. Ratio of rock to ore is 1:1 and plans are set for production of 3.6-million tons ore per year. Flotation plant at the mine will ship some 25,000 tons to the Bor smelter annually.

Government plans which are part of the $46.6-million project include:

1. Construction of the new smelter at Bor, with capacity for 55,000 tons per year, including facilities for recovery of sulphuric fumes now escaping.

2. New sulphuric acid plant for 230,000 tons H_2SO_4 annual capacity.

3. Fertilizer plant at Prohovo on the Danube to produce 575,000 tons superphosphate annually.

Who'll Supply Capital?

The Soviet Union has offered Yugoslavia economic aid for the purpose of exploiting copper ore deposits at Majdanpek, it was announced recently. Russia thus joined France, in negotiating with Yugoslavia, in competition for bid acceptance.

France, with U. S. backing, is reported to have offered a plant and mining machinery on credit bearing 5% interest. Repayment would be made over a five-year period with copper produced from the mine.

The Russian offer, considered more favorable, calls for a 10-year repayment period at 2% interest. Other commodities would be considered for repayment as well as the mined copper. Russian economic aid to Yugoslavia for the year already stands at the equivalent of $194-million.

In the recent visit of Marshal Tito to the USSR, it is presumed that further Yugoslav aid was discussed.

The possibility of exploiting Majdanpek has been under discussion for a number of years. In 1953 a Japanese expert investigated the area and reported to the United Nations Technical Assistance Board on the possibilities of exploitation.

Estimates set production for the area at 23,000 tons of blister copper yearly. Such output would bring total annual copper production for the country to 55,000 tons.

Completion of the whole plan is due in three years, with full capacity three years later. Annual production of 30 tons silver and 2,000 kg gold would also result from the new expansion.

A Decade of Iron

Total iron ore reserves known presently seem sufficient for the next ten years, observers say. Reserves have been estimated at plus 190-million tons.

Vares, the major deposit, contains about 77% siderite (34% Fe), 18% hematite and 5% limonite, with some 40 to 45% Fe. Orebody is syngenitic, consisting of siderite seams which are high in manganese and contain some barite.

With large scale mining of the Vares deposit, grade is expected to drop to 33%. Beneficiation problems are being studied. Sulphur in the ore is now removed in a sintering plant.

Ljubija, the second major orebody, is 75% high-grade limonite with 49% Fe; siderite with 40% Fe. Limonite is easily reduced and roasted siderite is brought to 55% Fe in processing. Some 17-million tons are indicated and inferred. Ore appears in veins and partially in irregular lenses and schists. Some manganese is present.

Ores from Vares and Ljubija are smelted at Zenica, Jesenice, Sisak and Vares. Zenica plant works two blast furnaces of 700 tpd pig iron apiece and a third is under construction. Installations at the other sites are smaller.

Following World War II, intensive exploration took place in Macedonia, with commercial ore found in the Slepce-Tajmiste-Demir Hisar area. Ore is iron chlorite chamosite, with 35 to 42% Fe, but with 0.7 to 1.3% phosporus, offering difficult reduction problems. The new mines are to go

into production in 1958, following intensive metallurgical research.

Some 28-million tons are indicated and inferred. The operation will be open pit.

Minor magnetite deposits are known in eastern Serbia at Rudna Glava and in the Ljubija region at Beslinac, but reserves do not exceed 300,000 at either find.

Aluminum's Promise

Main bauxite mining districts are: Herzegovina (Mostar), Dalmatia (Drnis), Istria (Rovinj) and Montenegro (Niksic). In 1955, Mostar supplied 29% of the total national output; Drnis 36, Rovinj 22, Niksic 18. The remaining 5% came from minor workings in northwestern Bosnia.

Largest part of mined bauxite is monohydrate; Dalmatian ore is trihydrate. The Bayer process seems most applicable for these ores.

Average assays for the major deposits are listed by Prof. Marusic as follows:

	$\%Al_2O_3$	$\%SiO_2$
Mostar	57.62	2.54
Drnis	52.36	2.82
Rovinj	56.10	4.22
Niksic	61.23	2.06

Quantity and quality of Yugoslav bauxites offer a solid base for the development of a domestic aluminum industry. Reserves are broken down into three classifications, as follows:

1. 55% alumina, less than 4% silica—13-million tons
2. 48% alumina, less than 4% silica—4-million tons
3. silica content of 4% to 8%—19-million tons.

Breakdown gives a total of 36-million tons of measured and indicated ore. Inferred ore in regard to bauxite is, in the opinion of Prof. Marusic, "merely a playground for one's imagination."

About 12.5-million kw are available for aluminum reduction, but it was not until the early 1950's that large-scale production was contemplated in Yugoslavia.

From 1915 to 1955, when some 13.5-million tons of bauxite were mined, only about 850,000 tons were consumed domestically (at the Lozovac aluminum plant near Sibenik and at a chemical plant at Ljubljana, Slovenia).

After the Second World War, Lozovac was enlarged from 2,700 tons annual capacity to 3,500. At Razina, near by, new works are nearing completion, including a 15,000-ton-per-year rolled products plant and a 4,000-ton-per-year electrolytic plant.

Principal center of the post-war aluminum industry is Kidrecevo (Strnisce) in Slovenia, where a new plant went on stream in the summer of 1954 with a first-phase capacity of 15,000 tons per year. Plant uses the Soderburg process, will double capacity in the next few years.

Another new plant has been proposed by the government, will probably be located either at Mostar or Niksic.

Major Chrome Producer

Yugoslavia is the largest chrome producer in Europe, with principal output coming from the main deposits in Macedonia (see map). Rabrovo, near the Greek border is not now operative, and Lojane, near Kumanovo, is reported exhausted.

Ore is classified as follows:

1. plus 48% Cr_2O_3, representing about 10% of the national product;
2. 48 to 42%, taking care of about 20%; and
3. less than 42% for the remainder.

Reserves, pending results of current exploration in Serbia and Macedonia, are placed at about 1-million tons.

Chrome ore appears in proportionally small orebodies in most cases, according to Dr. Kersnic. Chemical structure varies from alumochromite to chrompicotite. Proportion of chrome to iron varies from 2:1 to 3.6:1. Geologists believe that far larger districts of chrome-bearing peridotite exist within national borders.

Concentrates are produced by jigs and concentrating tables, with the lower grade ores being beneficiated at Dorce Petrov, near Skoplje, on tables. Recovery is rather low (69%) and assay of concentrates does not exceed 52% Cr_2O_3. A new mill has been started at Dakovica.

40% of the Antimony

Europe depends on Yugoslavia for 40% of its antimony, based on pre-World War II consumption. Bulk of present production comes from the Zajaca area of west Serbia, with a smaller portion from Bujanovac, in the south. Lisa mines are momentarily down.

Average content of ore is now slightly above 2% Sb, lower than the pre-war level. Since 1950, four flotation plants have been built; three in Zajaca (Brasina, with 200-tpd capacity. Stolice with 100, and Dobrr Potok, 100) and one at Bujanovac. Concentrates are smelted at Zajaca in a rotary furnace, producing antimony trioxide. Reduction takes place in reverberatory furnaces; refining of raw antimony in short-drum furnaces.

Antimony reserves are estimated at 65,000 tons Sb.

Bismuth and Mercury

Bismuth production has grown with the years. It come principally from the lead-zinc refinery at Trepca, where recovery began shortly after World War II. Production, in kilograms, follows:

1946	17,140
1950	56,280
1953	98,452
1954	109,699
1955	104,108

About 10% of Europe's mercury in the pre-war years was received from Yugoslavia, which then ranked third after Spain and Italy. Entire production comes from Idrija, Slovenia, which has been worked since 1500. From that date to 1955, when grade had declined from a reported 15% to the present average of 0.4%, total output has been 92,500 tons.

Main ore is cinnabar, though some native mercury is still found. Ore is picked and sorted, smelted in shaft and "shelf" furnaces, the latter of the Cermak-Spriek type, according to Dr. Kersnic.

With completion of a modernization and development program, Idrija will soon begin producing 600 tons quicksilver per year. Almost all production is exported.

Manganese Declines

Deposits of manganese within the nation are not expected to last much beyond 1960 at present consumption. Known sources are pretty well worked out and are low in grade: Cevljanovici (35%) in Bosnia, and Cer-Nebojsa (28%) in Macedonia.

Other possible sources are being investigated to cover future needs, among them the extraction of manganese from lead-zinc ores and from the Vares iron ores.

One new possibility is in the rhodochrosite occurrences in the lead-zinc deposits at Trepca and Zletovo. The carbonaceous gangue material is said to average some 30% Mn plus some Fe.

Capable Management—One of the Best Cures for Small Mine Headaches

DURAND A. HALL
G. I. BARNETT

IN THIS DAY of increasing large-scale operations—the San Manuels and the Climaxes—is there still an important place for the small mine operation in the business of mining? Most will agree not only that there is, but that the field may be one of increasing rather than decreasing importance. First, dependence is being placed upon small mines for the production of a considerable number of mineral commodities which occur only in relative small tonnages or orebodies—minerals which had little or no commercial value a few years ago. Second, increased prices of certain metals, particularly copper, are already stimulating small operations in this field. Third, a long range Government support program of some sort for the mining industry now under active consideration in Washington, will, if and when effected, tend to increase the number of small operations, as well as large ones. Finally, as has always been true, small mines occasionally have a way of developing into large ones as discoveries of large, low-grade orebodies result from development of higher grade deposits.

What are the Special Problems?

What exactly are the special problems of small mines that merit the consideration of the mining fraternity as a whole? All who get around mining camps for one reason or another see operations, especially small ones, so poorly conceived, laid out and operated that one wonders how they continue to function even on the assumption that they possessed an adequate ore potential to begin with.

(Here let us eliminate from consideration that large field of ill conceived ventures which had little or no commercial ore available and hence were doomed to failure before the mill was built. This is a different subject entirely, though perhaps an entertaining one.) Can anything be done to improve the situation, to decrease business fatalities, to increase profits, to encourage venture capital in mining, and finally to conserve our mineral resources? At this point it is well to emphasize that the failure of a mining enterprise because of poor management, bad or inefficient mining or milling practice, or for any reasons other than lack of ore often postpones indefinitely the usefulness of this particular recourse, if it does not permanently destroy it. Some of the problems involved, particularly those which are vital to the success of the small mine, will be discussed in the following paragraphs.

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What is a Small Mine?

But first let's define a small mine. A small mine is regarded by the authors as one which is normally, though not always, a single unit operation from on-the-ground management through mine to tailings pond, regardless of the number of tons per day treated, regardless of whether it be an underground or a surface operation, and regardless of the number of people employed. A small mine can rarely afford the extravagance, perhaps the luxury, of a non-resident general manager. Both responsibility and authority should be vested in the man on the job. He is not just the head of all departments from mine to mill but is frequently all the departments there are. Incidentally, a small operation should be as thoroughly departmentalized or integrated as a large one.

It is a small operation if when the ball mill is down for any reason, production ceases from mine to mill, while payroll and other costs continue. It is a small operation if when a slide occurs in the open pit the mill closes for lack of ore until it is cleared. There is a long list of vicissitudes which can vitally affect the success of a small operation but which are only of incidental importance to the large operator. Most of these are incident to what we have called single unit operation, rather than to size in terms of tons of ore treated per day. For example, the sudden failure of one ball mill out of ten, or one classifier out of five, is deplorable but not vital to the large operator. No single break in the tailings pond or failure for any reason of a single underground stope will interrupt or seriously cut down his production. Such incidents, however, and many others, if occurring frequently, may well be the difference between profit and loss to the small operator.

All mining problems in the main are essentially problems of management but in the case of the small operation, management itself is the principal problem. The management of a small mine is a man's job, certainly no place for a boy. Unfortunately, boys—not boys necessarily in age but small boys in experience and training—are running many of our smaller mining operations.

The situation is admittedly a difficult if not an anomalous one. Just about the time a good man acquires the experience and training to conduct a small operation he has also acquired the desire and perhaps the qualifications to manage a larger one. Often he has been working for people who consider the remuneration offered him somewhat in proportion to the size of the operation. But now the pay, the permanency, the prestige and the relative ease of his new job influences him to make the change. Furthermore, the field of small mine operation is often not attractive to the young engineer of some experience starting his career. Naturally, he sees in the larger companies a more permanent future, offering less chance for ingenuity and resourcefulness, it is true, but offering more security, if not more pay, and perhaps more comfort for himself and his family.

There's Need for Talent

The problem narrows down to this: First, to convince the small mine owner, whether individual, partnership, or corporation, of the importance of acquiring topnotch, experienced on-the-ground management at whatever cost in salary or bonus, or both, is necessary to win and to hold it. Second, to persuade the young qualified engineer that there is here a prime field for the development of his executive and technical talents, and at the same time opportunity to make some money for himself, a chance in some way to share in the profits with the owners, if the operation is successful.

No young man wants to start his career by being identified with a failure and unfortunately the mortality among small properties is rather high.

This one is going strong.

This one went out of business.

The Status of Two Small Mines

Here are two case histories that may shed some light on the problems of the small mine operator. At left we see Hecla's model Radon mine now a profitable uranium producer in Utah. It owes its success to good exploration techniques, adequate financing, excellent mine planning, good modern mechanical equipment, good management (which the authors of this article stress), and a generous Government-support price until 1962 and later.

Now let's take the other mine, a broken-down fluorspar property in Colorado. We don't know what the operator's problems were because he wasn't there when we took the picture. But these could have been some of his problems: Unsupported fluctuating fluorspar prices, excessive imports of low-cost foreign ores, high trucking and freight costs, high taxes, low depletion allowances, inadequate exploration, too much mine water, insufficient financing, primitive equipment, or inexperienced supervision. Understanding these problems, and devising remedies, is mining's great challenge.—*Ed.*

Therefore some judgment on his part is required in the choice of an operation. On the other hand, no large operation affords him the opportunity to learn so quickly not only the practice but the business of mining as does a small one. The experience acquired in the conduct of a small mine is rarely lost when the opportunity comes for a bigger job. Seldom, however, does the experience gained in the services of a large company qualify a man for the management of a small mine, that is, until long after he has lost the interest and the courage to step out on his own. Fewer and fewer qualified young engineers are willing to take a chance in the mining business and unless and until they can be shown that the stakes are high enough to be worth it, fewer and fewer will continue to do so.

It is possible that the failure lies largely with the small mine owner. If he is not himself a trained and experienced engineer, he does not appreciate the qualifications for good local management. He shrinks from the cost, and fears that a first-class man given the authority will spend too much money for equipment, supplies and services. On the other hand, he may be too ready to give a free hand to an inexperienced man, totally unqualified for responsibility.

Small mine owners are of various types. Some of them are natives of the district in which they operate—men who have come up the hard way to the rank of producers. These are the so-called "practical miners" for whom we have great respect and a despairing admiration. Experience has often made them good judges of ore and where it is to be found, but they frequently have little knowledge of or experience with modern or even well established practices.

How to Miss the Boat

For example, they see no need for daily assays in the mill and frequently have no idea of their mill losses, to say nothing of how to correct them. Too often they are suiting the mine to some second hand machinery they can buy cheaply, rather than suiting the equipment to the mine or the ore. Their mining operations grow like Topsy, without planning, and everything is wonderful until they are closed down by the state mine inspector. They take a dim view of maps and their importance and frequently have no planned program for exploration and development. These are perhaps the hardest men to convince of the value of sound engineering management, for what they see is the immediate cost, not the future profits to be derived therefrom.

A second type is the successful individual or leader of a group who has been "promoted into a mine," with the inducement of "tax money," as is so often the case today. Knowing nothing about the business of mining, it is astonishing how quickly he becomes an expert, though he is often the first to disclaim it. His judgment as to the qualifications of an on-the-ground operator is usually unsound. Of course he wants a "good man" but he himself wants to run the show from his city office. He hires what he designates as a local superintendent—"my man," not a qualified manager. He retains himself in the position of manager. Results are frequently such as would be expected.

There is also the already established mining company which takes on a new property. The basic experience and know-how is there, but the mistake is often made of trying to make all operational decisions for the new venture from city headquarters. Responsibility is placed in the hands of a mine and a mill superintendent, but rarely is authority vested in on-the-ground management. The purchase of as much as a drill or liners for the ball mill or a change in the tailings pond are accomplished only as a result of rec-

ommendations to headquarters for approval. In short, what should be run as a small operation is conducted as a large one. Many other types and examples could be cited.

The Man In Charge

Training, experience, resourcefulness, energy and diplomacy are basic requirements of the on-the-ground man in charge of a small mine. Some of the problems he faces are as follows:

1. A small mine often belongs to a small company or group. This means that ownership depends for success on this one particular operation. Up to a point it makes little difference whether the policy is to divide up the profits and go out of business when the mine is exhausted or to use some of the profits for the acquisition of other properties. So far as mining is concerned, the success of the owners depends on the success of this mine. They are not in the mining business for posterity, as are the large companies. It is essential in solving his problems that the manager have the confidence of his owners in the matter of financial policy.

2. One of the first mine managers we ever knew once said: "The first qualification for a mining engineer is his ability to do a job just well enough." He meant, we are sure, that it is easy to over-engineer an operation. This is particularly true of a small mine. It is easy to buy a brand new piece of labor saving equipment which does not actually save labor. Why buy a filter, for instance, when the daily production of concentrates is so small that it can be handled by the mill man, and the sun and settling tank will do the job just as efficiently. It takes the saving of freight on the extra moisture in a lot of concentrates to pay for a filter. The examples of over-engineering of a small mine are legion.

3. Small mines frequently have a short life. As a consequence, it is important that capital investment be kept in line with the probable life of the mine and still maintain efficiency. Sound judgment in the purchase of used equipment becomes important. Nothing, however, is worse than junk, the maintenance of which often far exceeds the cost of new machinery, both in actual cost and lost time.

4. Small mines do not have purchasing agents with large inventories in the warehouse to meet any emergency. The manager is the purchasing agent and one of his problems is to plan well ahead for future requirements, and know in advance where he can fill his needs on short notice to avoid replacement difficulties.

5. Small mines do not have metallurgical departments complete with laboratories to check daily operations and solve special problems which arise. Thus the manager of a small operation must organize and direct adequate mill controls within the limits of his working personnel.

6. Coordination between mine and mill is an even more vital problem for the small operator than for the large one. In many small operations, the manager must fill the functions of both mine and mill superintendent. If the mill is to be down then that is the time for repairs in the mine and vice-versa. Even rehandling from a stockpile costs money.

7. The importance of balance of equipment in both mine and mill to fit normal daily production has been mentioned. A small mine is particularly vulnerable to the mistake of trying to make the mining or milling job fit available used equipment rather than suiting the equipment to the job. It would astound some mine owners to know the losses they have incurred because of lack of trained foresight and planning in this regard. Often this is the result of underfinancing.

8. Labor problems are about the same for small mines as large ones, only more so. The quitting of key men for any reason is likely to be more vital than for a large mine. As a consequence, maintenance of good relations with his men is an important problem of the manager. Excessive labor turnover can ruin a small organization. Interest of the men in the success of the operation is of prime importance. Contract work and incentive pay in the form of bonus or otherwise whenever feasible, are recommended.

Initiative an Essential

These are but a few of the many problems which may confront the small-mine operator. It is obvious that he must have a free hand, and to deserve it requires initiative, resourcefulness, organizing ability and experience. With it all, the manager must have some time to put his feet on the desk and think. His "do it yourself" capacity must be confined only to essentials or emergencies.

Finally, if the manager is the right man he will welcome periodic visits from competent advisors and will urge the owners to provide such services. Both owners and manager should recognize that it is quite possible for the man on the job at times to be too near the woods to see the trees and that a fresh viewpoint or a new approach is vital to continued success.

There is much room for improvement in the management operation of the average small mine. This is true for two reasons: (1) lack of understanding on the part of small mine owners of the abilities needed to cope with the many special problems of small mine operation, and, (2) the dearth of qualified, experienced men available for small mine jobs.

The first can be overcome only by education. The mine owner must be convinced of what he is losing in cold, hard money by failure to meet successfully his operating problems before he will be willing to make their solution financially attractive to the qualified man. His increased profits will far exceed the increase in pay over what he has considered "normal" by studying the "Engineers Wanted" advertisements in the mining journals.

Can Consultants Help?

Operators of small mines should not overlook the important potential function of the consulting engineer in improving the economy and techniques of small operations. Unfortunately, in many instances he is called in when the patient is dead or nearly so. The consultant is often considered an unnecessary luxury until trouble is encountered. But it is only with great care and diplomacy that the consultant should advise the owner and operator with respect to problems of management when he is brought in to advise on the technical aspects of the mining, milling or geological problem. No matter how high his qualifications or how frequent his visits, the consultant is not a substitute for on-the-ground direction, and he should not attempt to fill this function even if given the opportunity.

Lack of qualified, experienced engineers, even for the large mining companies, is no new problem. The demand is still far greater than the supply. We are sure that money is not the only reason for this, but in the case of the small mine it is certainly an important one. Given the right inducements, the field of small mine operation should still be attractive to the man of initiative, courage and adventurous spirit who can look forward to becoming interested in mining for his own account and that of his associates, rather than for the account of a large company. The risks may be greater but the stakes should be higher too, to say nothing of the satisfaction.

New Ground Fault Protection Safeguards Open-Pit Workers

I. L. BOYUM

GROUND FAULT PROTECTION on mining circuits reduces hazards to workmen and equipment, and limits damage to equipment in the case of electrical faults. To reduce hazards, we must first recognize the hazards which exist. To do this, we must consider the possible electrical systems.

First let's study the three-wire ungrounded delta system. If one conductor becomes grounded, the other two wires immediately become delta voltage above ground or 1.73 times normal voltage. Under this condition any surges caused by lightning or switching can make the voltage to ground on the unfaulted conductors about 5¼ times normal. This situation is quite likely to cause one of the unfaulted conductors to go to ground somewhere else, causing a phase-to-phase short.

If one conductor grounds on one shovel and another conductor grounds on a second shovel, the two shovels will have a difference in potential equal to phase-to-phase voltage. This will cause a ground current to flow between the two shovels provided each shovel is fed from the same transformer. The potential gradient in the earth then is such that a workman could be killed without ever touching either shovel. It will be noted that intentionally grounding one corner of the delta will merely make the hazards permanent.

Grounded Neutral Helps—But Not Enough

To eliminate some of the above hazards, the system can be provided with a solidly grounded neutral. A neutral is established by wye connection of the power transformers on a 4,160v system or by addition of a zigzag transformer on a 2,400v system. This neutral is then effectively grounded. This definitely establishes the volts-to-ground of the phase conductors during normal operation, and under fault conditions to not much more than normal voltage.

This would seem like a good solution, but it has one serious defect. The ground fault current will be slightly greater than the phase-to-phase fault current. In the case of large transformer banks, this may be several thousand amperes. With high fault current, a ground fault can produce a large amount of damage to the equipment. A much more serious problem, however, is the hazard to the workmen. With the large ground fault currents possible, the IR drop in the ground conductor may be several hundred volts. This causes a current to flow through the earth from the shovel cats to the transformer ground. This again causes a voltage gradient sufficient to kill a workman not even touching the faulted shovel.

Why It's Important To Study This Article

Power distribution and safety of employees are just two of the many responsibilities which mine managers and operators have to shoulder. Both of these problems are covered in this article. The author, Mr. Boyum, has gone to considerable length to explain and illustrate how you can:

1. Prevent death or injury to your employees through proper electrical design.

2. Prevent damage to your heavy equipment with the right kind of protective electrical devices.

It may take study to get the full value out of this article, despite the simple language used by the author. Why not go over it with your master electrician or mine electrical department to see if you can capitalize on the suggestions offered?

The ideas presented here are not theoretical. They have been developed and tested by capable engineers in the Iron Country. The ground-fault protective system is now widely used in open-pit iron mines, and gaining wider acceptance in Western open-pit copper mines.

Resistance Grounding Limits The Fault Current

If a means can be provided to limit the fault current, the advantage of stabilizing the volts to ground of the line conductors can be retained and the hazard to men and equipment can be reduced. This can be done by grounding the transformer neutral through an impedance. This impedance may be either a reactor or a resistor. In the earlier attempts to apply this system, reactors were used. It was soon found that the reactance in conjunction with the capacity of the cable set up a resonant circuit in the event of a ground fault. This raised the potential of the entire system above average ground potential which in turn was quite likely to produce secondary ground faults. At present, all shovel transformer banks are resistance grounded.

Why We Must Use High-Ohm, Low-Amp Resistors

We have now established that the system should be four wire with the neutral grounded through a resistor. The next question is the size of the

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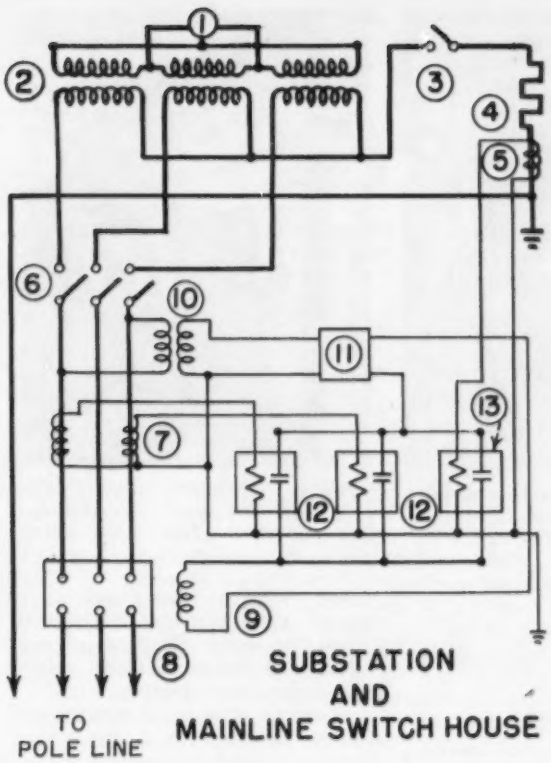
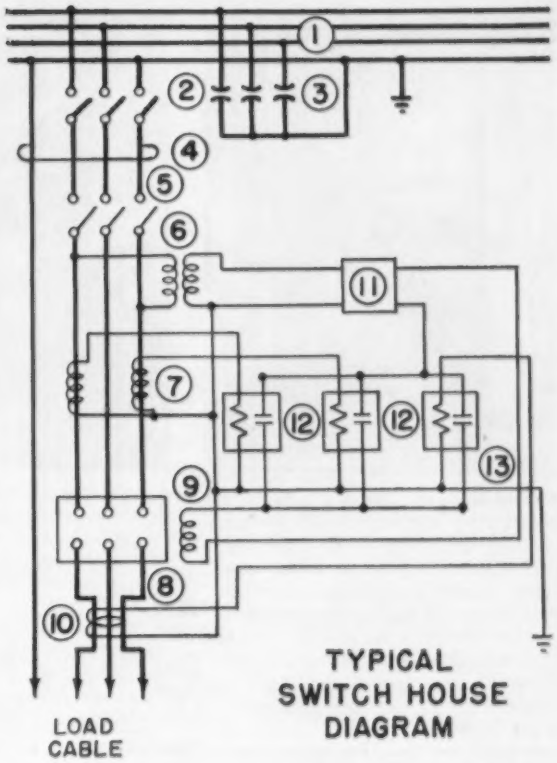
Note: The author wishes to express his appreciation to Mr. P. L. Hendricks, Hibbing district electrical superintendent, Pickands-Mather & Co., for supplying data used in the design of the ground fault current transformer and for the field tests which he has conducted.





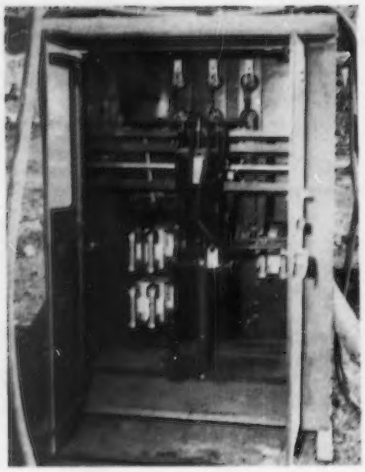
Key to Substation Main Line Switchhouse Diagram.

1. Primary protective equipment in line with local practice or power company regulations.
2. Power transformers. Secondary 4,160v wye or 2,400v delta with zigzag transformer.
3. Single-pole outdoor-type disconnecting switch.
4. Grounding resistor, 96 ohms for 4,160v, 55½ ohms for 2,400v.
5. Outdoor-type current transformer ratio 25/5.
6. Gang-operated dead-front disconnecting switch.
7. Current transformers for line relays, also instruments when used. Ratio to agree with power transformer rating.
8. Main oil circuit breaker manually operated. Rating to agree with short circuit current available. Most units are 50,000kva.
9. DC shunt trip coil for use with capacitor trip.
10. Control transformer for capacitor trip device and space heaters.
11. DC storage-type capacitor trip device.
12. Line overcurrent relays, type CO, 4 to 15 amp.
13. Ground relay type COH, ½ to 2½ amp set on 1½ amp tap.

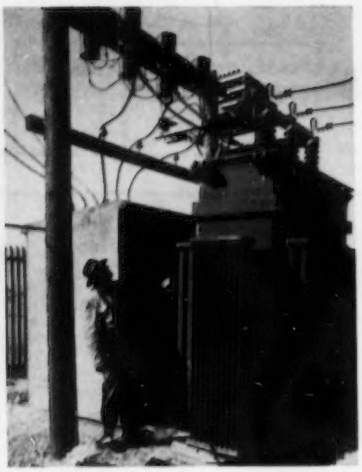
Key to Typical Switchhouse Diagram.

1. Pole line.
2. Disconnecting switches mounted on crossarm on pole.
3. Lightning arresters.
4. Cable—pole line to switchhouse.
5. Gang-operated dead-front disconnecting switches.
6. Control transformer for capacitor trip device and space heaters.
7. Current transformers for line overcurrent relays, meters and instruments.
8. Oil circuit breaker. Rating to agree with short circuit currents now available or probable in the future. Most switchhouse breakers are 50,000kva. Breakers are usually manually operated but can be electrically operated when switchhouse is used as a motor starter for such applications as pit pump motors.
9. DC trip coil for use with capacitor trip device.
10. Three-phase wound primary ground fault detector current transformer.
11. DC storage-type capacitor trip device.
12. Line overcurrent relays. For switchhouses used as motor starters, these will be 4 to 15 amp type CO, with time lever setting as required. For switchhouses, used for line sectionalizing, there will be 4 to 15 amp type COH with short time lever setting. For all other applications, these will be type SCI-instantaneous. To allow for motor starting inrush, these will usually be about 20 amp.
13. Ground fault relays. For switchhouses used for line sectionalizing, these will be ½ amp type COH with about No. 2 time lever setting. For all other applications, these will be type SCI-instantaneous with ½ amp current setting.

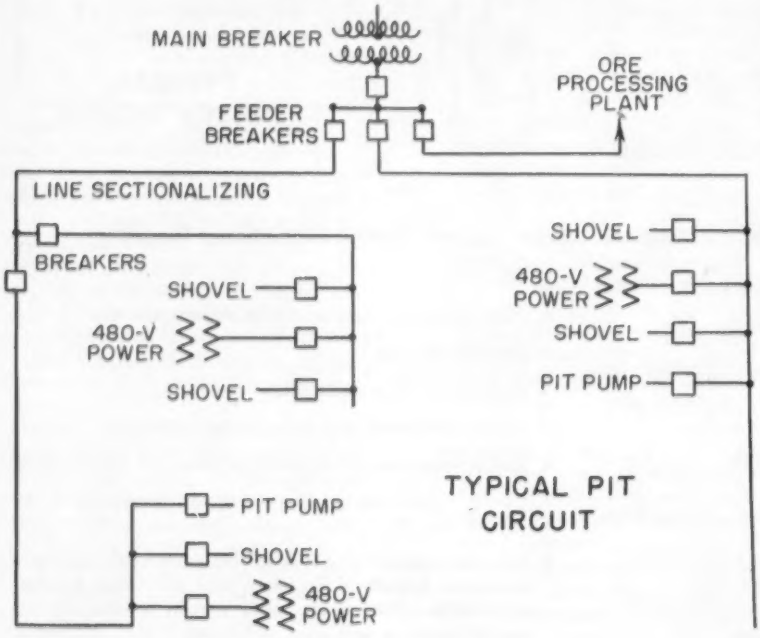
INTERIOR of portable switchhouse shows relay panel, circuit breaker and disconnecting switch levers.



INSIDE VIEW of high-voltage compartment exposes ground-fault current transformer in center.



TYPICAL OPEN-PIT SUBSTATION with transformer, main switchhouse and capacitor. Note portability of station.



TYPICAL PIT CIRCUIT

resistor in ohms and amperes. When a ground fault occurs, we have a closed circuit or loop consisting of one phase of the transformer bank, one line or phase wire, the fault, the ground or neutral wire and the grounding resistor. The voltage of the transformer is split up into IR drops in the above components. It follows then that if the resistor is low in ohms and high in current we will have a low drop in the resistor and a high drop in the line and neutral conductors and in the fault. This is better than a solidly-grounded system, but leaves considerable hazard to men and equipment. If we use a resistor high in ohms and low in current, we will have a high drop in the resistor and a low drop in all the other components. This distribution of voltage practically eliminates the hazard to the workmen. The low current also limits the damage to the equipment.

Relay Problems

From the above it is evident that the ground fault current should be as low as possible. This introduces another problem. With high ground fault currents, relaying is reasonably simple. With decreasing values of ground fault currents, relaying is reasonably simple. With decreasing values of ground fault current, relaying becomes more difficult.

The earlier attempts at ground fault current detection used the time-honored method of residual current connection of three-line current transformers. In this case we take the vector sum of the three secondary currents. Since the vector sum of the three load currents is zero, we have a residual current which is proportional to the fault current. The difficulty is that the current transformers had to be sized for the load currents and the ratio was then quite high. The result was that the fault currents had to be fairly high to get enough current to operate the ground relay.

How We Solved the Current Transformer Problem

The problem then is to get a current transformer which will carry the load current and yet have a low ratio. Various schemes were tried, such as booster current transformers, low ratio current transformers having high secondary currents, and others. None of these was entirely successful. After many experiments, we came up with an idea which was to take the vector sum of the fluxes which the line currents could produce, rather than the vector sum of the currents themselves.

We then built a current transformer having three primary windings insulated from each other and from the core for 5,000v and a single secondary. The three primary windings are connected in series with the load, the same as ordinary current transformers.

The secondary is connected to the ground relay. Under non-fault condition, the vector sum of the line currents is zero. The vector sum of the primary ampere turns is zero and the flux in the core is zero. Under ground fault conditions, a current flows in one line which is not present in the other two and we then have a flux in the core, which is proportional to the ground fault current. In turn, we have a current in the transformer secondary and relay circuit which is proportional to the ground fault current. Since there is no flux in the core, nor current in the secondary and relay circuit under non-fault conditions, we can have a low turn ratio.

We then have a low turn ratio current transformer which is universal in its application. It can be used on 2,400v delta systems with zigzag transformer or on 4,160v wye systems. It can be used on any load up to the thermal rating of the primary winding. The present transformer (S#1,-575,523) has a 300-amp primary which takes care of most feeder circuits and all shovel circuits. For heavier currents, we have found from tests that two transformers with both primaries and secondaries paralleled will give accurate results.

Establishing Ratio

We now have the current transformer so the next question is resistor rating and exact turn ratio. From field tests and calculations we established the resistor at 25 amp for a solid fault close to the substation. The turn ratio was selected to give a current ratio of 10:1 when used with standard switchboard relays. The lowest current rating of a switchboard relay is ½ amp for either instantaneous or induction type. With SCI relays this will give an instantaneous pickup of 5 amp. With COH relays the minimum pickup is 5 amp and a time satisfactory for most operations at about 10 amp.

A standardized switchhouse, incorporating the ground fault detector current transformers, has been developed. The accompanying photographs show the front view of a portable switchhouse including relay panel, circuit breaker and disconnecting switch levers; and an inside view of the high voltage compartment which includes the ground fault current transformer.

Note that the switchhouse is mounted on skids as a mine substation is frequently moved to follow the mining operation. This type of switchhouse is used by most of the operating companies in the Lake Superior region, and is gaining wide acceptance in the western copper mines.

The mine distribution system must be arranged and the parts coordinated to get the most effective use of line and ground fault protective equipment. To simplify this, we will consider the components separately.

Necessary Equipment

At the substation there will be the usual primary protective equipment. The power transformers will have 2,400v secondaries. They may be connected wye for 4,160v or delta for 2,400v. When connected delta, a zigzag transformer will be required to establish the neutral. The zigzag transformer should be rated 25-amp continuous. This will be 60kva. The grounding resistor should be outdoor mine type rated at 25-amp continuous. For 4,160v circuits this will be 96 ohms. For 2,400v circuits this will be 55½ ohms.

At the substation, a main line secondary circuit breaker will be required. This may be either an outdoor-type circuit breaker or a switchhouse. The switchhouse is preferred, as all instruments and relays and their associated transformers can be mounted in one enclosure. This reduces the hazard of false operation due to possible damage to the relay wiring. The relay equipment will consist of two line-overcurrent and one ground-fault relay. Both items are CO induction type. On the relay panel can also be mounted such items as ammeter, voltmeter, wattmeter and watthour-meter as desired. The switchhouse can be arranged for cable connection or with roof bushings for overhead connection to the transformers or pole line, or both.

Ground fault protection can be provided by the ground fault current transformer up to its thermal limit of 300 amp. An alternate method, which is independent of the size of the power bank, can be used. A 25/5 outdoor current transformer is installed in the grounding resistor circuit. The secondary of this transformer is connected to a 1½ amp type COH relay. It is evident that this method can only be used on main line breakers.

For those pits having only a single pole line, the line can be connected directly to the main line circuit breaker. If there is more than one pole line or if there is an ore processing plant involved, separate feeder circuits will be required. Each circuit should have CO line and ground relays. The ground relay is operated by the ground fault current transformer. The various circuits can each be controlled by a separate switchhouse or the main line and feeder breakers can be consolidated into a multiple section outdoor switchgear. Again roof bushings can be used for outgoing circuits.

If the layout of the property is such that the substation is some distance from the pit, a single circuit can be run from the substation to the pit, and line sectionalizing switchhouses installed at tap off points. The line switchhouses will have CO line and ground relays. The ground relay will be operated from a ground fault current transformer.

A separate switchhouse should be used for each shovel and other main pit equipment. Each switchhouse should have line and ground relays with the ground relay operated from a ground fault current transformer. In regard to the relays, originally these were induction type in line with utility companies' practice. However in shovel circuits, nearly all faults are in the cable or in the shovel slip rings. There is no point in using a timed relay in the hope that the fault will go away—it will not. All relays in a switchhouse should be type SC1 instantaneous. In those cases where a switchhouse is also used for a motor starter, as, for example, pit pump motors, the line relays should be type CO, but the ground relay should be type SC1 instantaneous.

Some operators put more than one piece of equipment on one switchhouse and fuse the separate circuits It should be noted that all faults start as phase-to-ground faults. With the ground fault current limited to 25 amp at the substation and less than that at the pit, the fuses will not blow so the switchhouse breaker will trip on ground fault. There is no way to get selective clearing by fuses, and they might as well be omitted.

The Same Principles Apply Underground as Well

The above comments apply to open-pit mines. In underground mines we have the same problems with possibly a higher probability of ground faults. All of the above comments, also apply to underground mines. We have one more problem in underground mines —that is we may have several cables in parallel feeding the underground load. We can supply a polarized relay which will give selective-ground fault tripping for the cable circuits.

In addition to mine systems, there are many other 2,400v delta systems where it is desirable to have selective ground fault tripping. This can easily be accomplished by adding a zigzag transformer on the bus and ground fault current transformers on each circuit, without disturbing any other parts of the switchgear.

BOOM JUMBO is used in drift to sill-out (wall-cutting).

GATHERING-ARM loader is used in drifting and silling.

Japan's Matsuo Sulphur Mine Is Big Underground Producer

YOSHIZO FUJITA

THE MATSUO MINE is one of the most highly mechanized mines in Japan and accounts for one-third of sulphur as well as of pyrite ore produced in Japan. It is thus an important source of raw materials for the Japanese chemical industry.

Ores are mixed, of free sulphur and iron sulphide. At the mine, anything containing over 25% free sulphur is called "sulphur ore." From these "ores," sulphur is extracted. Ores containing iron sulphide, but relatively little free sulphur, and whose total sulphur content is over 36% are called "pyrite ores" and sold to fertilizer companies who manufacture sulphuric acid from them.

During the period of about 40 years from 1914, when the Matsuo Mining Co. started its operation, to March 1955, the total ore produced amounted to 143,031,963 tons. Crude ore mined over past 5 years averaged 871,819 metric tons per year and chief products, pyrite ore and sulphur, averaged 583,273 metric tons and 59,465 metric tons per year respectively.

Ore is in Volcanics

The Matsuo deposits are located in Iwate Prefecture in northeastern Honshu, the largest of the Japanese Islands. They are found in a formation inclined 8 to 12 deg in a roughly easterly direction in which alternating beds of lava and pyroclast are from several meters to about 40 meters thick. It is chiefly of two-pyroxene andesite, but some contains olivine.

The geology of the district around the Matsuo Mine has been studied by many geologists of the Matsuo Mining Co. and of the Geological Survey as well as of universities. These studies show:

(1) There are roughly six eruption periods in each of the volcanic cones in the Iwate and Hachimantai group of volcanoes in the vicinity of the Matsuo Mine.

(2) Volcanic activity has been repeated cycles of acidic andesite gradually changing to basic.

(3) Cycle also runs: pyroclast, then pyroclast and lava in about the same proportion, and finally only lava. And this process is repeated.

(4) In volcanoes of the 3 to 5 eruption periods, craters are abundant. Many of the cones are chiefly of pyroclastic rocks. Their erupted rocks are mainly two-pyroxene andesite, but in rare instances olivine is found in the upper part.

(5) Volcanoes of 2 to 4 periods are of olivine-bearing two-pyroxene andesite, and only rarely of two-pyroxene andesite lava without olivine.

(6) Sulphur deposits are distributed in the 3 to 5 period volcanoes. Metasomatic deposits are among those of 3 period. While among those of 5 eruption period, sublimation-precipitation deposits predominate; but there are a few cases of disseminated deposits.

There are Three Orebodies

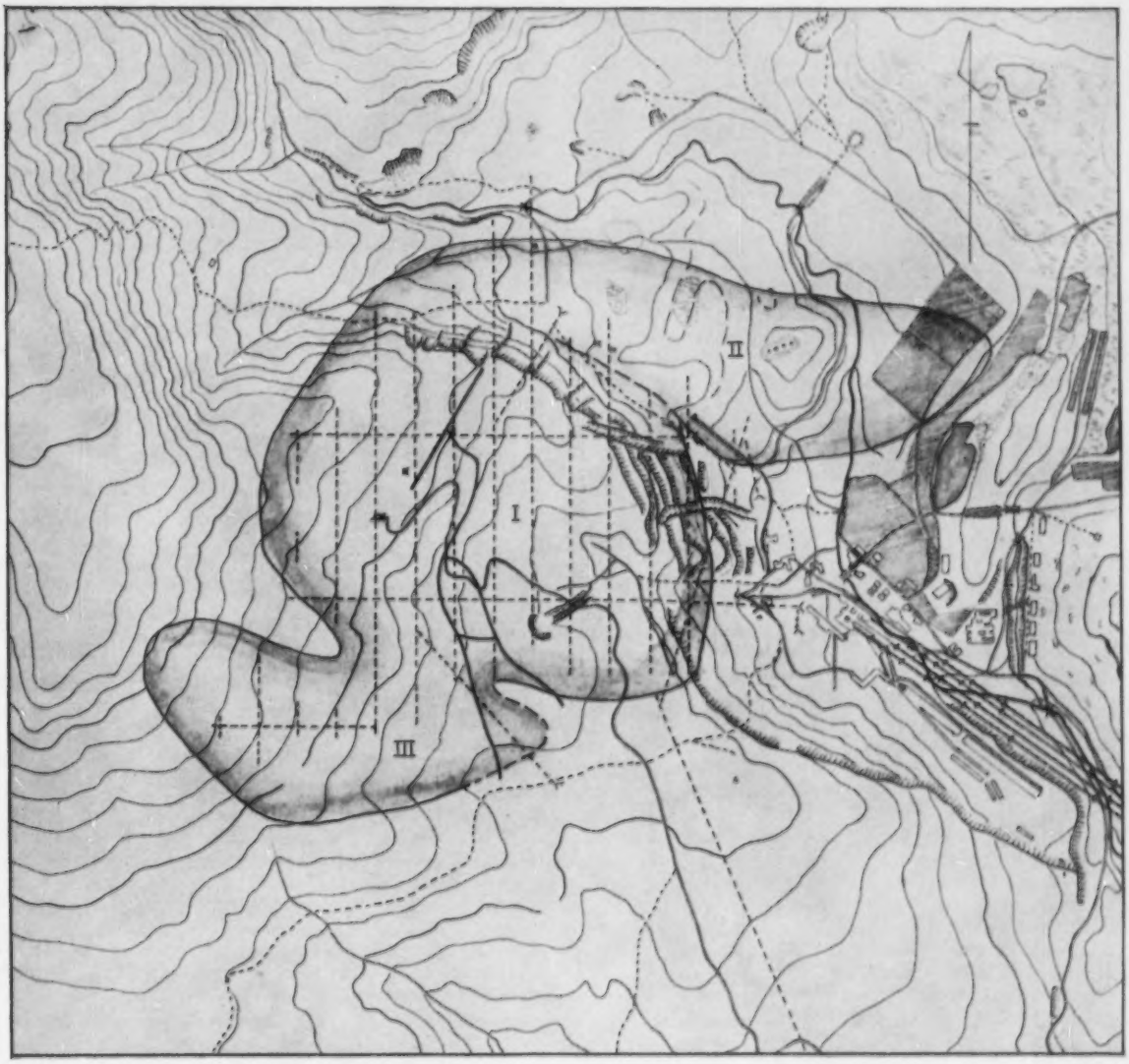
Deposit now being mined consists of three connected orebodies (see map). They were formed by metasomatism or impregnation (dissemination) when andesitic lava and pyroclast

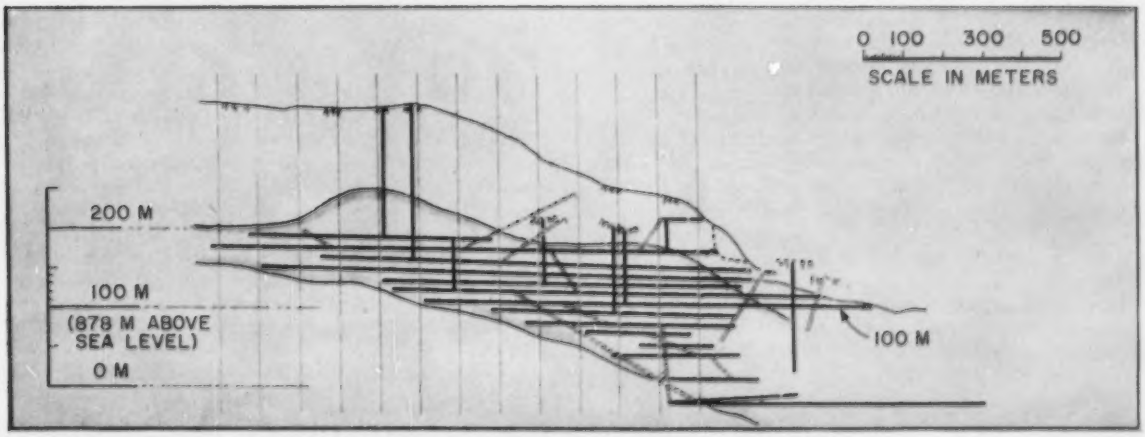
Output is Large

(Metric tons)	1951	1952	1953	1954	1955
Crude ore	914,528	926,793	770,608	874,282	872,883
Final product:					
Pyrite ore	649,312	623,316	483,043	584,978	575,715
Sulphur	52,606	61,298	61,394	59,498	62,531

Dr. Fujita is consulting engineer for Matsuo Mining Co., Ltd., Tokyo, Japan.

Adits Are Main Access to the Three Connected Orebodies





were penetrated widely by rising liquids or gas. These bodies are thought to have been formed in the same period. They were discovered at different times and by different methods because of irregular lower boundary of orebody. No. 1 body was discovered accidentally about 70 years ago when a lumberman made a fire. No. 2 body was discovered about 18 years ago as a result of drillings to find width of the No. 1 body. No. 3 body owes its discovery to geophysical prospecting which suggested its existence.

No. 1 orebody has an oval plan mass measuring 1,200 meters from east to west, 800 meters north to south, and 75 meters in thickness. Lower part is rich in free sulphur, but pyrite (including marcasite) increases as one proceeds upward, until in upper part of body free sulphur becomes extremely rare, ores becoming chiefly pyrite ores. Alunite, gypsum and barite are found in very small quantities.

No. 2 orebody has a triangular plan 1,300 meters east to west, about 300 meters north to south, and 40 meters thick, located north of No. 1 deposit.

No. 3 orebody adjoins No. 1 body on latter's southwestern edge. Prospecting is now going on in its northwestern and east-south parts by drilling and driftings. So far as has been determined, it has an oval plan measuring 1,200 meters from east to west, 600 meters north to south, and 40 meters in thickness. Ores are high-grade, rich in free sulphur and containing little iron sulphite. Original rocks are much more altered than in the No. 1 body.

The mine is located at an altitude of 878 meters above sea level. For purposes of operations, this level is designated as the 100 meter altitude level and all other levels at the mine are referred to this basic level. The places worked by the old method (see Mining Method section) are all in No. 1 orebody, at nine different levels from 76 meters to 172 meters. At levels between 66 meters and the drainage tunnel (—28 meters) in No. 1 orebody, and in No. 2 orebody, mining is by the new method (see Mining Method section). No development plans have yet been devised for levels below the drainage tunnel and for the No. 3 orebody.

Prospecting Is Continuing

Prospecting methods used vary from geophysical to drilling and drifting. Most of the present prospecting is to ascertain the extension of No. 3 orebody and the periphery of No. 1 body. As a result of the work of geologists, a great deal is now known about the deposits.

Prospect Drilling Hit Mostly Ore in 1955

Drilling Place	Direction	Total length	No. of bores	Average depth	Ore	Blank
Underground	Horizontal	2,954m	27	109.4m	27	
	Vertical	35m	3	11.7m	3	
	Inclined	1,065m	18	59.2m	18	
Surface	Vertical	2,248m	13	172.9m	12	1
Total.....		6,302m	61	103.3m	60	1

Geophysical prospecting is carried on at places where there is possibility of existence of deposits as revealed by results of geological surveys. Electrical resistivity prospecting is the rule, but seismic is also used when necessary. Prospecting area is about 1-million square meters per year.

Drilling is both underground and surface. Holes are spotted after analysis of physical prospecting, in turn based on geological surveys. The result has been a steady rise in the percentage of holes hitting the ores. Of 61 holes (totaling 6,302m) drilled in 1955, only one attempt was unsuccessful in reaching the orebody (see table).

Prospecting by drifts has the added purpose of preparing for mining operations. During the year 1955, a total of 9,455 meters of drift was opened.

Mining Method Has Changed

Room-and-pillar method was adopted at first when very little was known about the whole of the deposit. In this method, the deposit is divided off into blocks, each measuring 100 meters east to west, 33 meters north to south, and 12 meters in thickness. In each block, mining takes place at five rooms, each 10 meters wide, 28 meters long and 6 meters high. As the extraction ratio by this method is a mere 22.6%, it was decided in 1950 to fill the rooms with waste and to extract the 6m thick roof pillars. This raised the ratio to 45%.

In the parts which have not yet been developed, both extraction ratio and mining efficiency are being raised by dividing the orebody into blocks of 100 meters east to west, 100 meters north to south, and 30 meters thick. Again there are five working places, each room being 14 meters wide, 90 meters deep and 27 meters high. Illustration explains the order in which mining takes place.

Under this new method, the extraction ratio has gone up 12.2% to 57.4%, output per rock drill has been raised 38%, and explosives used per ton of ore has gone down 18%. When filling-in is done by gravity through vertical chutes, 38% more is filled without any labor.

Intensive studies have been made on methods of undercutting which precedes other mining and of drawing out the roof pillars, etc.

Light Drills are in Majority

A total of 140 drills are ready for use at all times. During the six months from January to June 1955, the average number of drills in use per shift was as follows:

Stoping	37.08
Development	27.24
Wall cutting	7.13
Total	71.45

About 87% of the rock drills are light drills known as A. S. D. -31:

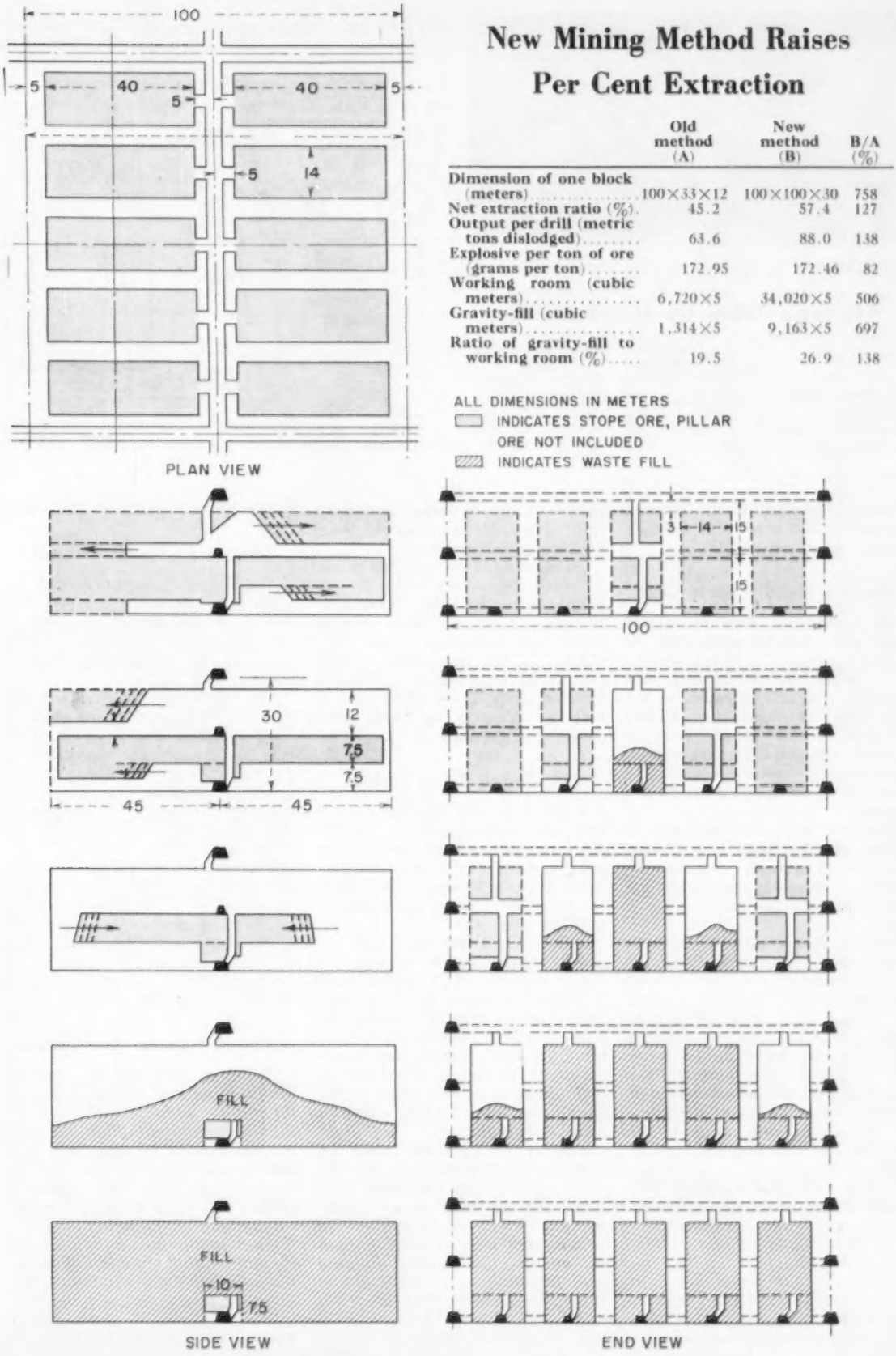
Weight of body	57 lb
Guide shell	38 lb
Cylinder diameter	3 in.
Stroke	$2\frac{23}{64}$ in.
Weight of piston	5.06 lb
No. of blows per minute	2,050
Air consumption	110 cfm

Bit used is detachable. It has a female tapered attachment and a tungsten carbide insert containing about 10% Co. Life of bit depends to a large degree on the quality of free sulphur in ore. Average, however, for a six-month period from November 1954 to March 1955, was 73.60 meters of hole.

Physical property of ore in relation to drilling is very much different from that in metal mines. Ore is not so hard, but tougher, with the result that height loss on bit is much less than gage loss; the former being only about 20 to 40% of the latter. After much research, the design shown in illustration has been adopted as standard bit. Starting bit gage is 44 mm, the cutting edge is curved, and is sharpened twelve times on the average, until gage is reduced to 28mm. (Diameter of dynamite used is 25mm.) Generally, new WC bit is used on soft sulphur ores and then used for drilling pyrite ores, life of the bit is thus prolonged. As bit is reground so many times, loss in gage due to grinding is about equal to that due to actual drilling. When bit is damaged, insert is sometimes removed and used to make a new

New Mining Method Raises Per Cent Extraction

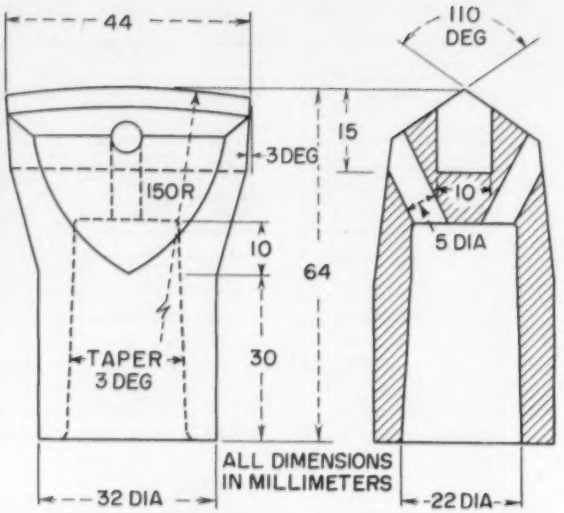
	Old method (A)	New method (B)	B/A (%)
Dimension of one block (meters)	100×33×12	100×100×30	758
Net extraction ratio (%)	45.2	57.4	127
Output per drill (metric tons dislodged)	63.6	88.0	138
Explosive per ton of ore (grams per ton)	172.95	172.46	82
Working room (cubic meters)	6,720×5	34,020×5	506
Gravity-fill (cubic meters)	1,314×5	9,163×5	697
Ratio of gravity-fill to working room (%)	19.5	26.9	138



APARTMENTS on right are replacing old housing on left.

Average Tram by Hand Is Low

(kilometers)	On 136-meter level and above		Below 136-meter level	
	Exploitation	Exploration	Exploitation	Exploration
By hand	0.060	0.151	0.085	0.266
Electrically drawn	1.604	1.795	1.326	0.894
Hoisted	.....	.....	0.185	0.461



STANDARD BIT at Matsuo has taper attachment and insert.

detachable bit. Old inserts soldered together, as well as new tips, are used to make new insert bits.

Slushers Handle Most Ore

All loading was done by manual labor until 1949, but since 1950, all loading is mechanical. In development work, loaders are usually used; and in stopes, slushers. However, in the early stages of stoping, face loaders are used because it is difficult to maneuver slushers. On the other hand, in some drifts, slushers are used. More than half the ore is loaded by slushers at present.

The mine cars are 0.9 cu meters in volume, have a capacity of 1.3 metric tons, and are made of wood; but they are being replaced by steel cars of 1.0 metric ton tare, 2.0 metric tons of load.

Main haulage is on 136- and 100-meter levels. Ore from 12 meters or more above these levels is all dumped into a winze. From winze, it is loaded into cars at chute gates on haulage levels and transported outside the mine. Ore from below the 100-meter level is hoisted up the incline to the 100-meter level and transported out of the mine in cars. Outside the mine, the ore is again hoisted up to the crushing and screening mill on the 136-meter level.

Cars are either hand-pushed, electrically drawn (storage battery or trolley) or hoisted. The average distance the ore is carried by different methods is shown in table.

As the heads of exploration drifts are pushed further inward, the hand-pushed ton-kilometers increase every year. Effort is being made to push electrically drawn trackage as far inward as possible to reduce the hand-pushed ton-kilometrage.

Filling of early openings left in No. 1 orebody by mining under the old method began in 1950. It increased strength of pillars, and hence added to safety and protection against subsidence. At the same time, it made possible the extraction of ores left in the roof pillars. Cut-and-fill method is used in all areas developed since adoption of new method.

Fill Comes From Surface

Filling is carried into the mine at 160- and 100-meter levels. Surface dirt from upper part of the deposit is filling material carried in at the 160-meter level. On 100-meter level, burnt remnants from refinery are carried in as filling material.

Surface dirt is obtained at open excavations and loaded by scrapers onto Granby-type cars of 2-cu meter capacity. Cars are drawn by diesel locomotives to fill shaft in the mine and distributed from there to places being filled. Filling is dropped into mined-out rooms through the winze, the dirt being dumped into the winze by the tipple. Slushers level the inside of rooms being filled.

Refinery remnants are loaded on to conveyors by drag-scrapers and carried to gate on the 100-meter level. There they are loaded onto Granby-type cars which are drawn into the mine by electric locomotives operated on batteries. The quantity of filling used since filling operations started is: (in cubic meters) 1950—40,360.3; 1951 — 98,916.2; 1952 — 165,260.0; 1953—213,315.4; 1954—271,959.0; 1955—268,832.0; 1956—1,058,642.9.

Fire is Particular Hazard

The orebodies contain cavities left when marcasite melts, and ores contain great quantities of free sulphur. This places many restrictions on mining operations not generally found in metal mining.

The combustible nature of free sulphur and the heat producing effects of easily oxidizing iron sulphides, combine to give a spontaneous combustion fire hazard. Thus any mining method in which broken ore accumulates, i.e. shrinkage or caving, is impractical. Ore mined must be transported out of the mine within a few days.

Explosives give off an immense amount of heat at time of blasting and set ore on fire. If undiscovered the fire can lead to one of major proportions. If watering and flooding is ineffective in putting out the fire, there is no other way but to seal off the area to cut off the supply of oxygen.

Poisonous Gases are Danger

Poisonous gases can be classified into (a) those that are endogenous to the orebody arising out of the peculiarities of the deposit itself, (b) those that are formed by mine fires, subsidence and similar events, and (c) those that are formed as a result of blasting and which are thus necessary concomitants of mining operations.

Gases endogenous to orebodies are nitrogen, sulphur dioxide and hydrogen sulphide. When water seeps into clayey zones in the orebody, the result is the formation of druses (voids). These druses are often filled with at-

mosphere with little oxygen content, that is, with relatively high nitrogen content or sometimes with sulphur dioxide gas. These gases, depending on variations in temperature, humidity and atmospheric pressure, are expanded in the druses and effused out. This happens especially when the outside atmospheric pressure is low and temperature is rising. To prevent this, compressed air may be pumped in, or local fan use. Sometimes the system of air draughts is temporarily adjusted in part to get rid of the effused gas. Even so, it has at times been necessary to suspend mining operations until air has cleared sufficiently.

Hydrogen sulphide gas is always found accompanying spring water, and is thus effused at different spots continuously. But it is of such small quantity and only at such limited spots that it rarely affects operations.

A certain portion of the mine where fire and subsidence occurred, is at present sealed off. Within this area there are nitrogenous and sulphur dioxidous gases. These sometimes seep out. Whenever this happens, the sealing is renewed and seepage stopped.

Blasting causes microscopic particles of sulphur and pyrite to burn instantaneously giving off a considerable amount of sulphur dioxide gas. At the same time, condensation of water vapor takes place with particles of ore dust as nucleus, particles which float in great quantities in the atmosphere. This makes breathing difficult and greatly reduces visibility, preventing efficient operation. The inspection of the working place after blasting necessitates the wearing of gas masks. Even with mechanical draught, work at the spot is rendered impossible after a blast at least for one shift.

Acid Mine Water is Problem

Considerable ground water flows into the mines. Total volume measured at the mouth of drainage tunnel is approximately 25 cu meters per minute. Average pH is as low as 1.9, and it corrodes anything made of iron—like rails and pipes. It also makes the use of pumps uneconomical, and hence 2,913 meters of drainage tunnels have been cut into which all mine water is channeled. Sometimes druses in the orebodies contain great quantities of water. When drifting operations penetrate such druses, there is a sudden, and in at least one particular instance, disastrous gushing forth of water. Thus before work can start on a drift, an advance drill hole is sometimes necessary. But it is usually not possible to forecast the location of such druses. This is still a problem.

Ratio of Free to Combined Sulphur Influences Fire Hazard

Until 1949 there were many fires caused by ores catching fire at time of blasting, and 75 Dräger's rescue apparatus units were always on hand to be used in putting out fires. But it is always difficult to try to extinguish fires in Dräger's outfit in high temperature atmosphere full of sulphur dioxide gas. It may sometimes result in the loss of human life. A fire in January 1950 was put out only after a major portion of the mine was sealed off. This led to the problem of fire prevention being taken up with renewed seriousness. Not only were fire equipment, tools and materials renovated and made more adequate, but intensive studies were made of the records of past fires.

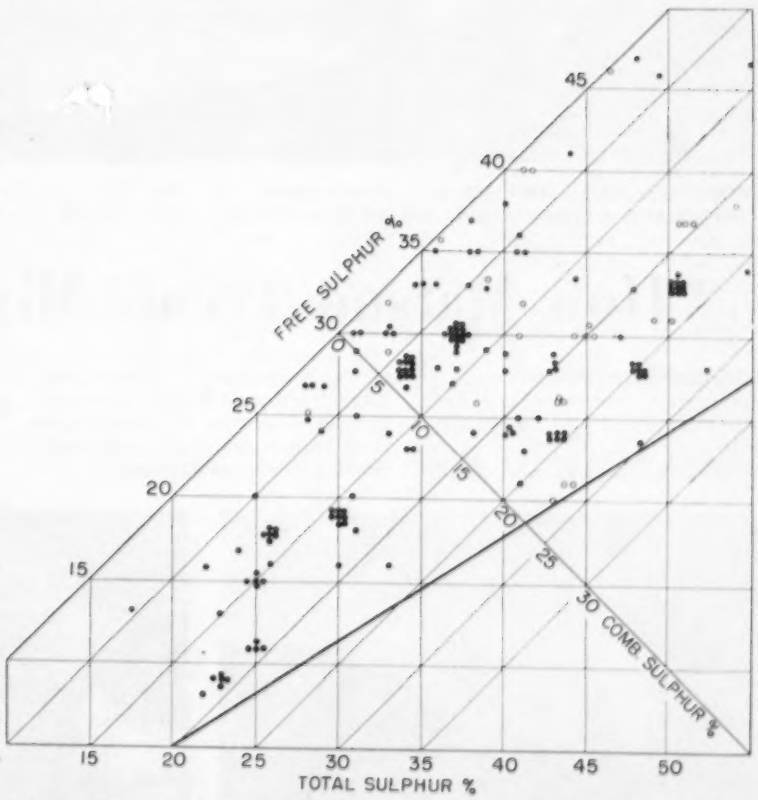
It was discovered that fires are more likely to start when there is a certain ratio between free sulphur and combined sulphur (iron sulphide), as shown in graph. To cope with this situation, the following measures were initiated:

(1) When blasting ores which are likely to catch fire, the ores are watered before and after blasting. About half of the working places require this precaution.

(2) Inspection is made after blasting to discover any fire which may have started.

(3) If there is any burning, water is turned on immediately.

Watering before and after blasting, inspection and early discovery and extinguishing have been enforced rigidly, and as a result there has not been even one instance of fire from blasting since January 1950. The conviction that correct measures can prevent all fires, has greatly increased efficiency, helped in the modernization of operations and contributed to technical progress.



PLOTTING each fire against composition of ore shows most happen when within certain limits—above heavy line.

THOROUGH AND LOW-COST mine water treatment at Yashikidai keeps acid-contaminated water out of the Akagawa (Red River), permits Matsuo Mining Co. to mine and produce some 600,000 tons a year at Yashikidai, northern Honshu.

How Matsuo Treats Mixed Sulphur-

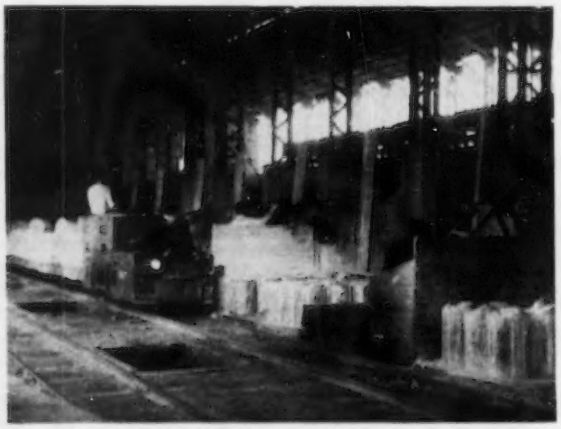
YOSHIZO FUJITA

Dr. Fujita is consulting engineer, Matsuo Mining Co., Marunouchi, Chiyoda-Ku, Tokyo, Japan.

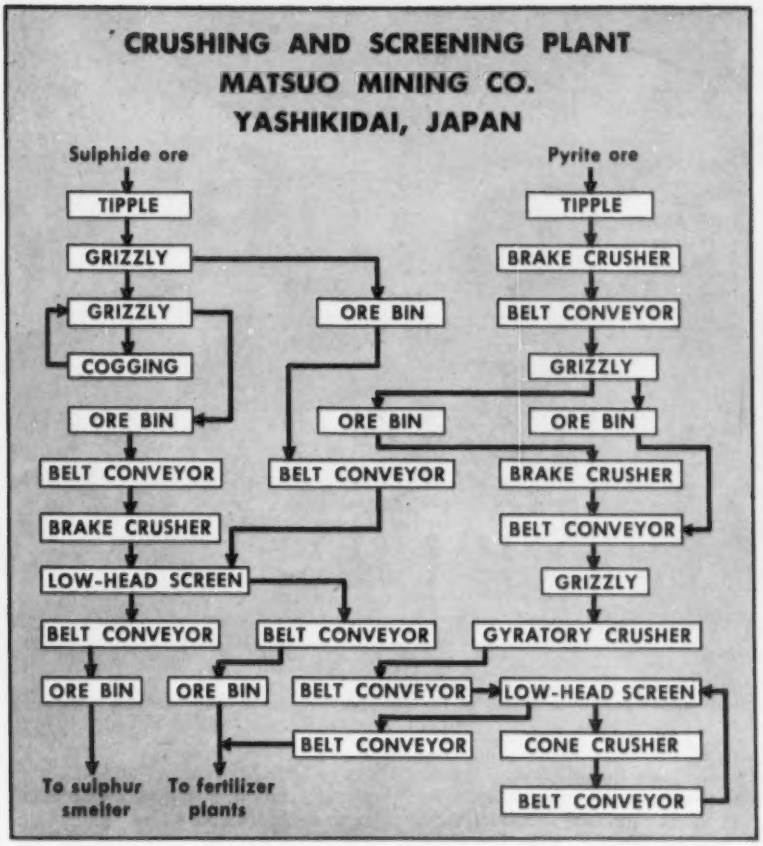
LOCATED IN IWATE PREFECTURE, northern Honshu, Matsuo Mining Co. produces one-third of Japan's sulphur and pyrite; making that company a leading raw material source for the Japanese chemical industry.

In the past 40 years, Matsuo has produced some 143-million tons ore. In recent years her sulphur production has been 52,606 tons (1951); 61,298

SMELTER in the background produces almost 60,000 tons refined sulphur a year by batch methods in cast iron pots.



COOLED AND CAST sulphur is collected by a battery locomotive in the smelter and delivered to the aerial tramway station.



Sulphide Ore

tons (1952); 61,394 tons (1953); 59,498 tons (1954); and 62,531 tons in 1955. At the same time, Matsuo has yielded more than 500,000 tons pyrite a year. The pyrite figures are 649,312 tons (1951); 623,316 tons (1952); 483,043 tons (1953); 584,978 tons (1954) and 575,715 tons in 1955.

Mine ore is mixed sulphur-sulphide. At the mine, anything with more than 25% free sulphur is called sulphur ore. From this, sulphur is distilled. Ore holding iron pyrite, but relatively little free sulphur and running about 36% contained sulphur is called pyrite ore. This goes to fertilizer manufacturers for sulphuric acid production.

An additional feature at Matsuo is that mine ore must be kept moving with little or no surplus on hand, due to the tendency of the material to oxidize and set the free sulphur on fire.

Two plants crush and screen the separated ores: one for sulphur ore and the other for pyrite ore. Free sulphur ore and pyrite and sorted at the mine face and delivered to their respective screening plant. Sulphur ore is crushed and sized to minus 30 in. and to minus 1 in., while pyrite is crushed to minus 1 in.

The two plants together operate 16 hours a day and handle 3,350 tons ore.

Sulphur is refined by distillation from sulphur ores with about 27% free sulphur. The process is called "Yakutori." Cast iron or 13% chrome stainless steel cauldrons (volume about 0.4m³ and capacity about 0.24 tons ore) are placed in two rows, five cauldrons to each row. This makes up one unit and measures 5.9m wide, 10.8m long and 2m high. There are 100 such units at Matsuo.

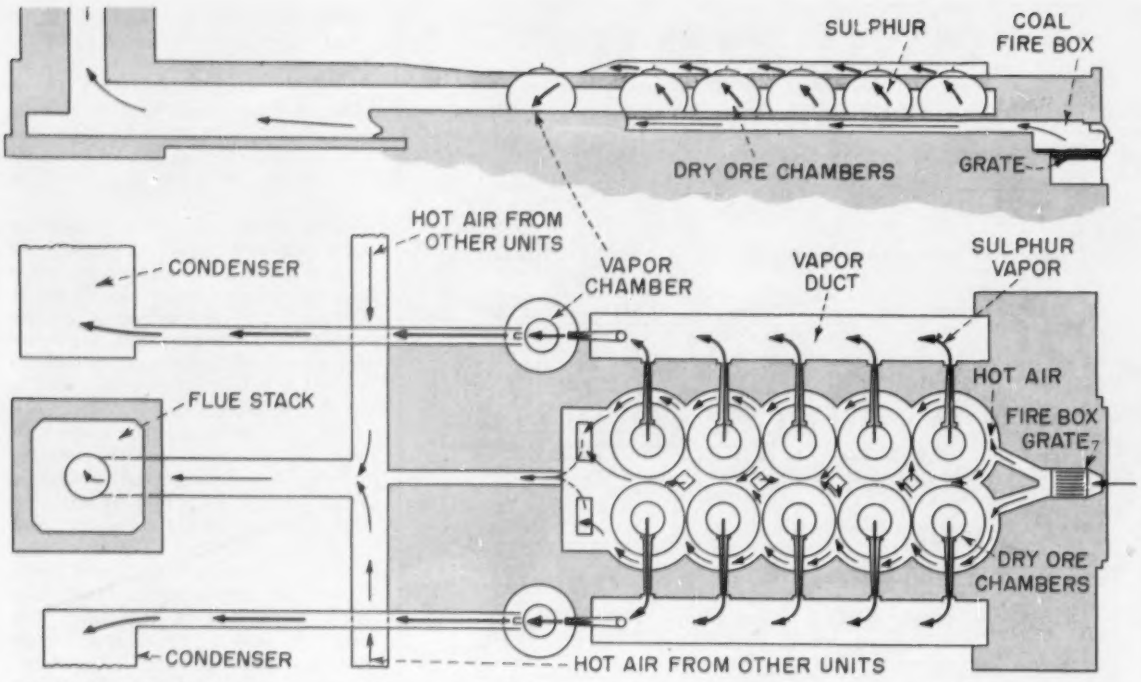
Ore, dried by waste heat drier, is placed in the cauldrons four times a day (once each shift) and heated. From the heated cauldrons, free sulphur vaporizes through the conduit pipes to condensers on both sides of the furnace. It condenses and is held here until its temperature drops to 180 deg C. Then, it flows into storage bins to cool to 120 deg C. When cool, sulphur is poured into cylindrical aluminum molds, ready for shipment.

Free sulphur recovery is about 75 to 80%.

About 0.41 ton coal per ton sulphur product is needed to fuel the furnace. Residue from the cauldrons is raked out, dumped into tub cars drawn by battery locomotive, for the ash-heap.

FOUR SINGLE-ROPE TRAMS, one for sulphur and three for crushed pyrite ore, move concentrates to railroad depot.

COMPANY-OPERATED electric railway carries freight (2,000 tpd) and passengers 12.2 kilometers to the National Railroad.



PLAN AND SECTION through batch sulphur unit shows heat flow and sulphur vapor flow. Each unit has one condenser on each side of the furnace, but several units converge and use the same flue-stack. From condensers, sulphur flows to coolers.

While these 100 distillation units are turning out about 3,000 tons sulphur a month, we have a 500-ton per month pilot plant testing out a dry continuous method. This unit has a vertical shaft furnace with intermittent top feed and bottom residue discharge. Heating and distillation chambers are arranged alternately as in a set of batteries, separated by a fire brick wall. The inside wall of the distillation chamber has numerous ascending passages through which vaporized sulphur escapes to the vapor chamber. From this vapor chamber, sulphur vapor passes through a duct into the condenser.

Drier ore goes by bucket elevator to the furnace top, where it is fed intermittently into the distillation chamber through the feed opening. Inside the furnace, ore sinks slowly by gravity and is heated through the diaphragm walls as it settles. Sulphur vaporizes through the duct into the condenser where it liquifies and is reclaimed.

Furnace residue automatically drops out through a rotary valve and is conveyed to the ash-heap.

This furnace is fired by producer gas.

Refined sulphur and crushed pyrite are shipped on four, single-rope aerial tramways: one exclusively for sulphur and the other three used for pyrite. Sulphur tram handles 26 tph, while pyrite trams haul about 40 tph. Trams carry products a distance of 3,600 meters, with the difference between high and low point being 400m.

From the tramway, product moves to Matsuo Mining railway, travels a distance of 12.2 km on this all electric line to the National Railroad line. Average daily traffic is 2,000 tons freight and 1,350 passengers on the company's line.

Shipments to distant points are loaded onto ships at the Hachinohe pier, operated by Matsuo. This pier can take 3,000-ton vessels and load them at 150 tph.

Handling Acid Mine Water

The drainage tunnel in the mine collects water at the rate of 25m³ per minute. It contains sulphuric acid, ferric and ferrous sulphate at a pH of 1.7 to 1.9. This water goes to mine water treatment plant, where it is neutralized and cleaned with calcium carbonate and slaked lime. Thickener sludge settles in a 30m diameter thickener. Pulp zone is 4m deep at the center and 2.7m at the lip. Sludge is allowed to settle a second time in the settling pools below, while clear water overflows to the river.

Akagawa (Red River) flows over the orebody through the center of the mine property. It has an average pH of 2.5 and flows at the rate of 10m³ a second.

An additional problem is the water oozing out of the burnt residue ash-pile. It has a pH of 1.8 and once flowed into the Akagawa at 1.3m³ per minute, contaminating and extending its undesirable effects into the lower reaches of the river. To stop this, an attempt to shunt this pile water underground through bore holes was made in July 1952. This contaminated water now goes underground where it is decontaminated and prevented from reaching the Akagawa.

These two methods proved entirely satisfactory. Water sent underground does not effect the river. And, up to March 1956, over 2-million m³ of mine water have been neutralized and filtered at the plant. Maintenance of the treating plant has been very low.

Employees' Welfare Considered

From the end of the Matsuo Mining railway at Yashikidai, to the mine, a distance of 8km, not a single dwelling or plot of ground belongs to outsiders; the property all being owned by the mining company. There is thus no miner forced to commute to work from far away.

At the mine, 385 dwellings house 4,500 employees, with a total population of 14,000.

For these people, the company runs stores, a hospital with resident physicians, a school, sports and recreation facilities, a theater and a social club.

All in all, Matsuo Mining Co. spends 2 to 3 times as much per employee on welfare items as does the general run of Japanese mining companies.

Reinsulate with U. S. Uskorona and "D. R." Tapes

A cable becomes as good as new when you reinsulate with Uskorona and re-jacket with "D.R." splicing compound. The "D.R." compound provides an outside vulcanized covering. These completely reliable tapes give:

- Extra-tight grip plus high tensile strength.
- They stand up under acid, alkalies and moisture . . . ideal for mining machine cables.
- Dangerous leaks can't occur, because pinholes are impossible.
- Absolutely waterproof.

Like all the tapes and splicing compounds in United States Rubber Company's complete line, Uskorona was developed for specific operating conditions, yet can handle a wide range of electrical and general purpose jobs. It exceeds A.S.T.M. specifications.

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Mechanical Goods Division

United States Rubber

NEW BOOKS

Industrial Electricity, Volume I, Direct Current, by Chester L. Dawes. Third edition. High school math and physics only prerequisites needed to tackle this text on the application of dc current to industrial situations. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y. Appendix and problem section, plus 348 pp. Price $5.50.

Surveying Instruments and Methods, for Surveys of Limited Extent, by Philip Kissam. Second edition of this textbook that offers a short and neat course on the fundamentals and practices that make up the bulk of our surveying duties. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y. Log tables and 335 pp. Price $5.75.

Plant Operator's Manual, by Steve Elonka, Associate Editor, *Power* magazine, McGraw-Hill Publishing Co. This is an operating-idea type book on many phases and problems of plant operation and maintenance, particularly power plant maintenance. By McGraw-Hill Book Co., 330 W. 42nd St., New York, 36, N. Y. 277 pp. Price $5.

Engineering in History, by R. S. Kirby, S. Withinton, A. B. Darling and F. G. Kilgour. A general pictorial account of engineering developments in Western civilization. By the McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y. 516 pp. Price $8.50.

United States and Canada, by Alfred J. Wright. Second edition of this textbook on the geography of North America. Published by Appleton-Century-Crofts, Inc., 35 W. 32nd St., New York 1, N. Y. Maps, photos and drawings in 577 pp. Price $7.

Basic Procedures of Diamond and Shot Core Drilling, by Acker Drill Co., Inc. Scranton, Pa. 35 pp. Price $1.

Microscopic Petrography, by E. W. Heinrick. Illustrated textbook on thin section work on igneous, sedimentary and metamorphic rock. Published by McGraw-Hill Book Co. 330 W. 42nd St., New York 36, N. Y. 274 pp. Price $6.50.

Economic Geography of Industrial Materials, edited by Albert S. Carlson. Twenty-nine authors put together this textbook. Although the subject is economics, little or no production-cost data is presented. Covers transportation, fuels, minerals, natural and synthetic products and food. Unfortunately the book seldom offers data more recent than 1953. Published by Reinhold Publishing Corp., 430 Park Avenue, New York 22, N. Y. 475 pp. Price $12.50.

Dynamics of International Relations, by Ernst B. Haas and Allen S. Whiting. Basic premise of this book is that present national ideas and institutions shape international relations. It uses a group-behavior approach to study international relations from the policy-makers viewpoint. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y. 531 pp. Price $6.

Technical Digests, U. S. Edition, Published by the Organization for European Economic Co-operation and distributed by OEEC Mission Publications office, 2000 P St., N. W., Washington 6, D. C. This new monthly service will abstract over 1000 foreign technical publications each month for timely or new ideas. Subscription rates are $24 a year or $2.50 a copy.

1955 Black Market Yearbook, by Franc Pick. Reports the more than $8-billion volume of black market deals made in 1954 by private individuals and governments. Pick also reviews the world's major currencies, their devaluation and fraud elements. Published by Pick's World Currency Report, 75 West St., New York 6, N. Y. Price $25.

American Standard Safety Procedures for Quarries, M28.1-1955. This safety standard is available from American Standards Association, 70 E. 45th St., New York 17, N. Y. Price $1.50.

Modern Techniques of Excavation, by Herbert L. Nichols, Jr. Short version of his *Moving the Earth,* **(See** E&MJ BOOKS, June 1955). Published by North Castle Books, Greenwich, Conn. 330 pp. Price unlisted.

Substructure Analysis and Design, by Paul Andersen. Second edition brings up to date practice and theory in foundation engineering. Textbook covers earth pressure, sheet piling, soil-bearing power, breakwaters, wharves, piers and abutments. Published by Ronald Press Co., 15 E. 26th St., New York 10, N. Y. 331 pp. Price $7.

Introduction to Modern Physics, by F. K. Richtmyer, E. H. Kennard and T. Lauritsen. Fifth edition of this International Series in Pure and Applied Physics issue. Covers history, relativity, electrons, quantum, atom, a wave mechanics, x-rays and cosmic rays. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y. Text in 650 pp. Price $8.50.

High Temperature Technology, by I. E. Campbell of Battelle Memorial Institute. Sponsored by Electrochemical Society and published by John Wiley & Sons, Inc., 440 4th Avenue, New York 16, N. Y. Materials and methods in 526 pp. Price $15.

Legal Problems in Engineering, by Melvin Nord. Covers every legal subject bearing on the engineering profession; and how to help the lawyers get you out of trouble. Published by John Wiley & Sons, Inc., 440 4th Avenue, New York 16, N. Y. 391 pp. Price $7.50.

Light Metals Handbook, by George A. Pagonis, Vol. I, text; Vol. II, tables. Covers magnesium-base alloys, aluminum and aluminum-base alloys. Published by D. Van Nostrand Co., Inc., 120 Alexander St., Princeton, N. J. Two volumes, 432 pp. Price $9.50.

Reports and Bulletins

Memoir No. 47, Geology and Archeology of the Little Caledon River Valley, by D. J. L. Visser and C. van Riet Lowe for the Geological Survey, Department of Mines, Union of South Africa, Pretoria. Maps, plates and 50 pp. Price 5/.

Report No. 7, Geology of Portland Creek, Port Saunders Area, West Coast, by S. J. Nelson for the Department of Mines & Resources, Province of Newfoundland, St. John's. Map and 58 pp.

Report of the Director of Geological Survey, 1954-55, Gold Coast. Can be obtained from the Government Printer, Accra, Gold Coast; or for Crown Agents for Overseas Governments and Administrations. Map and 13 pp. Price 2/.

Report of Investigation No. 5, Geology of the Serle Military Sheet, by Millard L. Reyner and Robert K. Pitman; plus *Hydrology of the Serle Sheet,* by R. I. Chugg. Can be obtained from the Department of Mines, South Australia, 31 Flinders St., Adelaide. Map and 19 pp.

Minerals and Industry in Tanganyika, by C. B. Bisset. Geological Survey Department of Tanganyika. Mineral map and 13 pp.

In JENKINS *Monel-seated Bronze Gates*

THE WEDGE* TAKES THE WEAR - *and spares the rings*

Easy replacement of the wedge only — right on the line — restores full efficiency

THE MONEL SEAT RINGS are expanded into the body to assure a positive, leak-proof joint. Exhaustive tests in typical monel-seated gate valve services show that this permanent all-around support of the rings is essential to guard against deforming, loosening, or shifting.

***THE RENEWABLE WEDGE** (bronze or nickel alloy) has excellent wear resistance, but has a lower degree of hardness than the heat-treated Monel rings, which have optimum resistance to erosion and corrosion as well as abrasion. Thus, wear of the wedge leaves the rings relatively unaffected. When necessary to renew the wedge, you simply remove the valve bonnet, slip the old wedge off the stem, and slip on a new one.

GET PRACTICAL, LOW-COST RENEWABILITY in the valves you choose for the tough, punishing services that require Monel-seated gates. Compare . . . there is nothing simpler, faster, or more economical than Jenkins replaceable wedge design — and you also get the *plus* of Jenkins *extra value* in every other feature. Jenkins Bros., 100 Park Ave., New York 17, New York.

***MADE WITH BRONZE OR NICKEL ALLOY WEDGE**

The bronze wedge provides lasting economy for most applications. The nickel alloy wedge provides extra resistance where rapid wear and corrosion are factors.

JENKINS BRONZE GATES WITH MONEL SEAT RINGS

200 psi	300 psi
Fig. 270-U, Bronze Wedge	Fig. 280-U, Bronze Wedge
Fig. 270-UN, Nickel Alloy Wedge	Fig. 280-UN, Nickel Alloy Wedge
Fig. 270-UL, Bronze Wedge, U.L. approved for L.P.G. Services	350 psi Fig. 280-UX, Bronze Wedge

JENKINS BRONZE GATES INCLUDE 40 DIFFERENT PATTERNS

125 • 150 • 200 • 300 • 350 psi SOLID WEDGE • SPLIT WEDGE
SCREWED • FLANGED • SOLDER END • SOCKET END QUICK OPENING

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VALVES
SINCE 1864 TRADE JENKINS MARK
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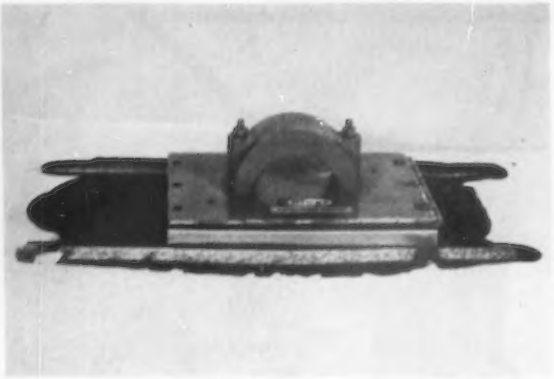
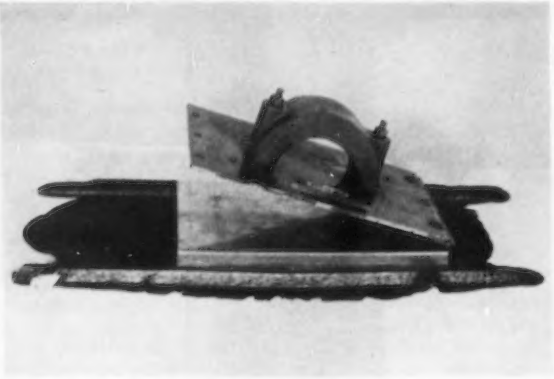
Lloyd E. Antonides



LOADING POSITION for magnetite-ilmenite separation.

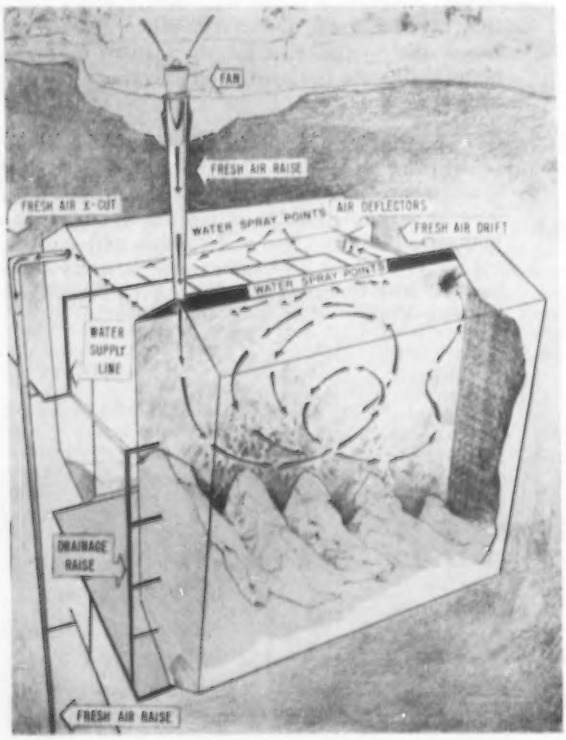


HINGED PLATE is lifted to unload magnetic separator.

Simplified Magnetic Separator for Laboratory

IN THE FIELD OR IN THE LABORATORY, magnetite is often removed from samples of beach sands and crushed ore by one of the following methods: (1) the induced roll magnet, (2) high-tension separator, (3) heavy liquids, or (4) by spreading out sand particles in a thin layer and passing a paper or plastic wrapped horseshoe magnet back and forth over the layer. Magnetic particles are recovered by removing the paper from the magnet. The last procedure can be made simpler and more accurate by using a plate magnet constructed as shown above. A flanged aluminum plate of $\frac{1}{16}$-in. sheet is attached to the plate magnet with a hinge. With the flanged plate in a position parallel to the magnet shoes, the entire assembly is pulled over a thin layer of sand previously made smooth and uniform in depth with the spreader consisting of a rectangular metal plate cut so that one edge has $\frac{1}{8}$-in. projections at the corners.

The flanges hold the magnet at a constant height above the sand. Magnetic particles are removed from the apparatus by holding it over a pan and opening the hinge. The plate can be purchased as a unit with large steel shoes attached to the magnet poles to increase the effective magnetic field. *R. Shoemaker, Metals Research Lab., Niagara Falls, N. Y.*



Ice Warms Air in Winter Cools It in Summer

INTERNATIONAL NICKEL CO. is air conditioning its Frood-Stobie mine in the Sudbury District of Ontario with a unique system that takes advantage of the fact that freezing water gives off heat, and thawing ice absorbs heat. The diagram at left shows how this system works. The fan that delivers the air to the underground has a diameter of 198 in.—one of the world's largest units. At top capacity, it blows 750,000 cfm through a 20-ft diameter airway into two large open stopes. In cold weather, water is sprayed at the top of the stopes to make ice, and the latent heat of freezing is transferred to the air thus yielding warmth to the mine. In summer the warm air from the surface is cooled as it passes over the ice. Even though surface temperatures during winter have gone as low as 25 deg below zero, the fresh air delivered to the main intake of the mine 600 ft below varied on between 27 and 30 deg above zero. In summer as the ice melts, the mine air will be cooled between 5 and 10 deg. Volume of water required in winter months varies up to 200 gpm.

SOME 40,000 TONS OF ICE were formed at the bottom of the stopes during the past winter. Sprays in the stopes delivered about 200 gpm to form ice.

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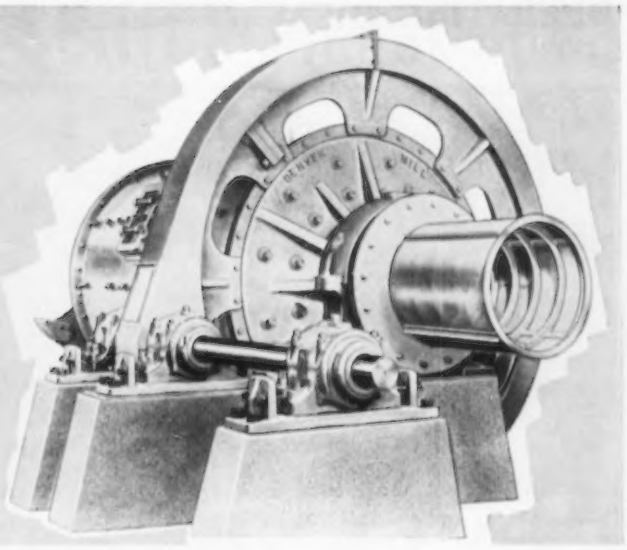
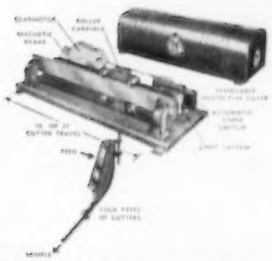
Crushers, Screens, Feeders, Ball-Rod Mills, Classifiers, Jigs, Pumps, Samplers, Agitators, Conditioners, Flotation, Thickeners, Filters, Dryers, Ore Testing and Mill Design Services.





DENVER AUTOMATIC SAMPLERS

. . . for Positive Mill Control

- Accurate Sampling
- Representative Sampling
- Uniform Sampling
- Rugged Construction

Denver Equipment Co. can supply you with a variety of samplers to meet the many different problems involving size of material (either wet or dry); amount of sample; and frequency of sample cuts.

For complete information, WRITE FOR BULLETIN NO. S1-B4.

COMPARE SPECIFICATIONS AND PRICE OF DENVER STEEL-HEAD BALL OR ROD MILLS

INCREASED CAPACITY—Savings in Initial Cost

The size of a DENVER Ball or Rod Mill is determined by the *working diameter* inside the liners, rather than diameter of the shell, as many other mills are measured. Therefore, DENVER *Mills have up to 32% more capacity*—with resulting savings in initial cost, since you can buy a shorter mill for the same volume of feed. Sizes from 30″x18″ to 7′x16′.

GREATER STRENGTH—Longer Ball Mill Life

DENVER Ball or Rod Mill heads are cast from electric furnace steel, giving greater strength and longer life. Trunnions are designed for low bearing pressure.

COMPARE SPECIFICATIONS—PRICE

Every engineer planning a new Ball or Rod Mill installation will want to study the specifications of DENVER Mills.

1. Larger working diameter—more grinding capacity.
2. Larger bearing surfaces—low bearing pressure.
3. Electric cast steel heads—greater strength.
4. Choice of liners, gears and drive—greater flexibility.
5. Standard construction—faster delivery.
6. Complete wet or dry, single or two-stage systems.

WRITE FOR BULLETIN NO. B2-B13

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CIRCULATING DIESEL FUEL is chilled in tank with dry ice. Temperature of liquid drops to —10 deg F thus freezing drill core and cutting core losses.

DRILLERS REMOVE frozen core which is heated to volatilize diesel fuel.

New Freezing Technique Insures Drill Core Recovery

CONVENTIONAL DRILLING METHODS were unsatisfactory in the Gas Hills area of Wyoming's Fremont County until drillers developed a new technique for recovering cores. Now they recover 98%.

The problem was to obtain a representative sample without washing away the sands.

The new method involves freezing the core with circulating diesel fuel. It was developed by Jack Bailey, Utah Construction Co. project manager; Don Anderson, chief geologist; Don Snow, assistant geologist, and Howard Bartlett, geologist of Lucky Mc Uranium Co.

Utah Construction was faced with evaluating the uranium orebody. Dry air drilling was no good below the water table. Conventional water coring gave very poor results, too. Below the water table the shales cored well, but the sands tended to wash away.

When freezing weather came, use of water with regular coring methods became increasingly difficult. Utah Construction began using diesel fuel instead.

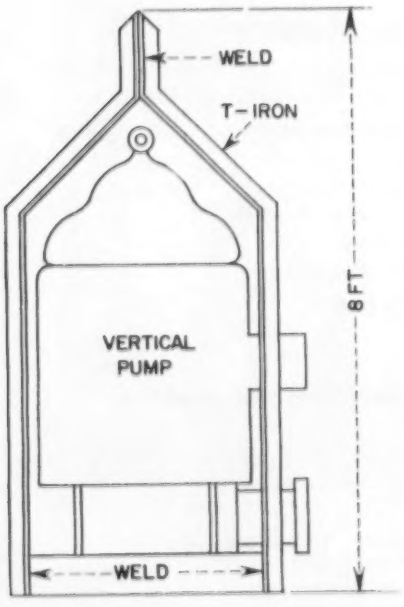
Drillers noticed that on colder days, core recovery was better. So why not freeze the core in the unconsolidated zones below the water table?

Utah Construction brought in an insulated tank (see illustration) and filled it with dry ice. By circulating the diesel fuel through the tank, the temperature of the liquid was lowered to —10 deg F and core recoveries were nearly perfect.

As the chilled diesel fuel circulated through the drill hole, it froze the core so that loss was negligible.

Core from the hole was heated at low temperatures to volatilize and drive off the diesel fuel before the sample was pulverized and analyzed.

The drilling process is comparatively expensive, but Utah Construction is working on ways to cut cost. Some of the diesel fuel loss in the ground ahead of the bit before the core was frozen was eliminated by reducing pump pressure. Drillers are working on methods to cut core-pulling time.



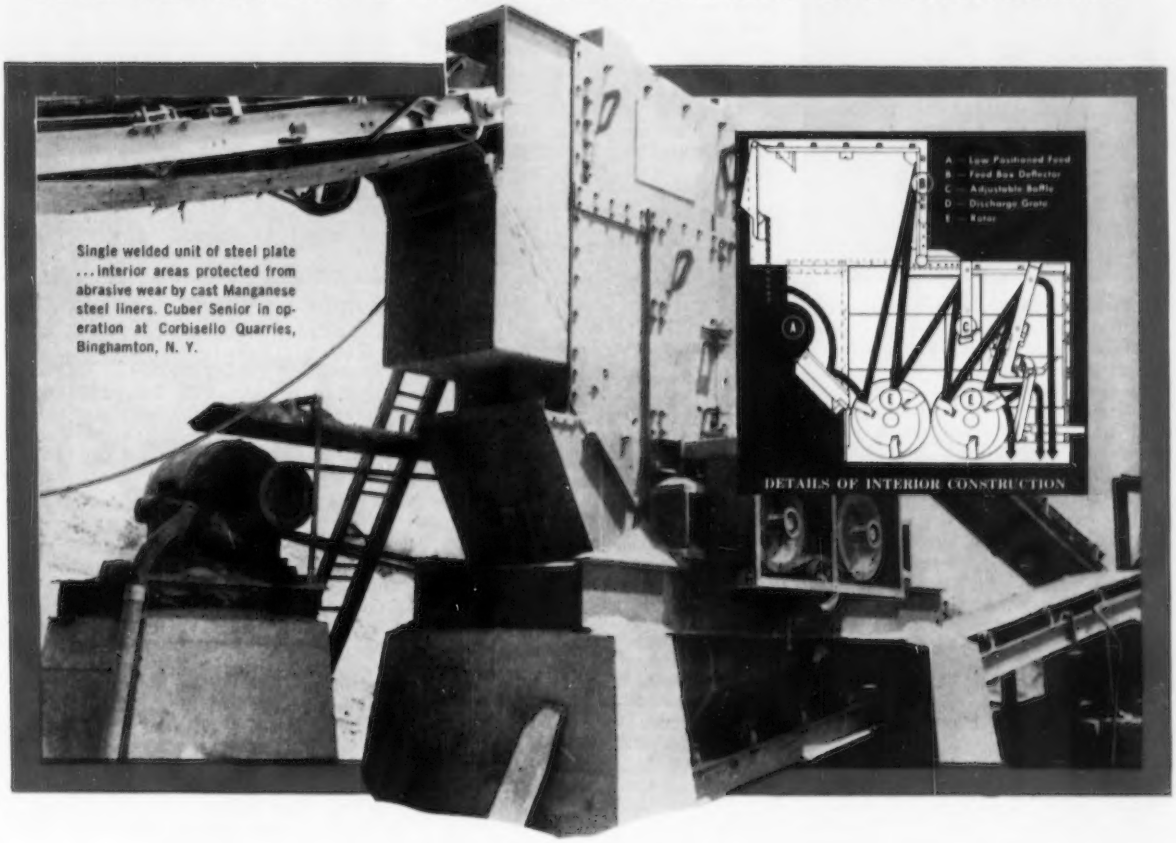
"T" Member Forged Into Pump Hanger

WHEN FLASH FLOODS hit an area or a plant, emergency pumping equipment may have to be improvised and moved in fast, according to Paul C. Ziemke of Oak Ridge, Tenn., who submits this operating idea. A recent flash flood inundated a large area under excavation for the foundations of a coal treatment plant, two 300-ft smoke stacks, and a boiler plant. Water stood 40 ft deep in the smoke stack excavation where clay and shale had been removed to bed rock. A diaphragm pump plus two 300-gpm centrifugal pumps were not enough to handle the dewatering job. So a yoke of structural steel was hastily constructed to suspend a 200-hp vertical pump as shown. Stock used consisted of T-iron with 4-in. web and ⅜-in. walls. This steel was heated in a coal-fired forge. Members were forged with 10-lb sledges on the shop anvil. Forged members were then welded by electric arc. After the pump was secured in the yoke, a ⅜-in. link chain was used to fasten the top of the yoke to the hook of the yard crane used to lower the pump as the water level went down.

KENNEDY CUBER SENIOR Model 3648

Multi-Stage, Regulated Flow Impact Breaker
for Primary and Secondary Crushing

DUAL ROTOR, TRIPLE ACTION . . . PORTABLE and STATIONARY


A — Low Positioned Feed
B — Feed Box Deflector
C — Adjustable Baffle
D — Discharge Grate
E — Rotor
DETAILS OF INTERIOR CONSTRUCTION

Single welded unit of steel plate . . . interior areas protected from abrasive wear by cast Manganese steel liners. Cuber Senior in operation at Corbisello Quarries, Binghamton, N. Y.

Handles quarry rock freely passing the 36″ x 48″ feed opening. Reduction chamber has 130 cu. ft. capacity . . . lined with cast Manganese steel wearplates. *Only moving parts* are two identical rotors, each equipped with three rigidly mounted cast steel Manganese hammers with single operating face, adjustable for wear.

Full gradation control. Safety device protects machine from tramp iron damage. Available in Stationary or Portable Models. *Send for bulletins giving specifications and full operating data.*

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PERSONALS

R. W. DIAMOND, recently retired executive vice president, Western region, Consolidated Mining & Smelting Co., has accepted the presidency of the Sixth Commonwealth Mining and Metallurgical Congress in British Columbia, Sept. 8, 9 and 10, 1957. Congress plans call for cross-country inspection of important Canadian mining operations by 500 delegates from all parts of Canada.

Dr. Robert F. Mehl, director of metals research laboratory and head of metallurgical engineering at Carnegie Institute of Technology, has been awarded the "Grand" Medal of Le Chatalier by the Council of the French Society of Metallurgy. Presentation will be made at the society's annual dinner.

Richard W. Livingston, ore dressing engineer for Jones & Laughlin Steel Corp., has succeeded **John D. Boentje,** vice president and general manager of Pacific Isle Mining Co. as chairman of the Minerals Beneficiation Sub-section of the Minnesota Section, AIME. **Chelsea R. Phillips,** sales engineer with Hewitt-Robins, Inc., is vice chairman, and **Leon D. Keller,** metallurgical engineer with Dorr-Oliver Co., is secretary-treasurer.

Harry G. Gerber, general plant foreman for Erie Mining Co., has been transferred to the Bristol-Quebec Co., Ltd., Hilton iron mines operation, as superintendent.

Alan M. Simpson has been named president and general manager of Beaver Mesa Uranium, Inc., succeeding **Robert E. Simpson,** resigned. **Mark Holloway** was appointed treasurer.

At the board of trustees' meeting of St. Joseph Lead Co., a resolution was passed honoring **George F. Weaton** for his more than 35 years of service with the company. It was resolved that a power plant was to be constructed at Josephtown and named The George F. Weaton Station.

Robert E. Lawence has been named managing director of Mines Development International, S. A. with headquarters at Box 201 Nassua, and operating office at 1209 Ainsley Bldg., Miami, Fla. The company is engaged in exploration and development of mining interests in Latin America and the Caribbean.

Robert J. Linney has been named vice president in charge of operations of Reserve Mining Co., according to announcement of W. M. Kelley, president of the taconite processing company which is jointly owned by Republic Steel Corp. and Armco Steel Corp. Linney has been manager of operations for Reserve since he joined the company at Babbitt, Minn. in 1950. He later moved his office to Silver Bay, Minn. Linney managed mining properties in New York State for Republic before joining Reserve.

Ossi E. Palasvirta, development engineer for Oliver Iron Mining Division of U. S. Steel, has returned to Mountain Iron, Minn. from a six-week tour of ore dressing plants in Finland, Sweden, Norway, Germany and France.

B. J. Hamilton, former general manager of Esquilache mine, is now operations manager for the mining interests of Mauricio Hochschild in southern Peru. Company operates the 500 tpd San Antonio de Esquilache lead-zinc mine, the 200 tpd Sucuitambo silver-gold mine, and is presently installing a 200 tpd mill at the Condoroma lead-silver mine.

Dr. Donald S. Clark, professor of mechanical engineering, California Institute of Technology, has been nominated president-elect of the American Society for Metals. Nominated for the post of vice president was **George M. Young,** technical director of Aluminum Co. of Canada. Others nominated were: **C. H. Lorig,** assistant director of Batellé Memorial Institute, treasurer; and **George A. Fisher,** International Nickel, and **Carl E. Swartz,** consulting metallurgist, trustees.

Martin J. Hughes, former superintendent of iron ore mining and beneficiation for Lone Star Steel Co., has joined Kaiser Steel Corp. as mine manager at Eagle Mountain operations, Riverside County, Calif. He succeeds **James G. Hansen** who will supervise the opening of the Cushenberry limestone deposits in Lucerne Valley.

James B. Hustad, project engineer for Cartier Mining Co. Ltd., in Montreal, Canada, has been transferred to Oliver Mining Division's Duluth office, and is succeeded by **James Steel.**

W. C. Wernnicke is now with United States Smelting, Refining & Mining Co.'s oil division as petroleum production engineer.

Ford W. Knight, former research engineer with Anaconda Co.'s Anaconda plant prior to receiving his Master's degree in Metallurgical Engineering from Montana School of Mines, is now with E. I. du Pont de Nemours & Co. as metallurgical engineer.

GEORGE B. MORAN has joined Freeport Sulphur Co. as vice president, and will act as vice president in charge of domestic and foreign sales. Until accepting this position with Freeport, Mr. Moran has been a vice president of the Hanover Bank. He joined the bank in 1946 as assistant secretary and has been manager of the Broadway, New York City, branch since 1954.

Norman B. Obbard has been named assistant executive vice president-operations of United States Steel Corp. He is succeeded in his former position as president of U. S. Steel's American Bridge Div. by **Austin J. Paddock,** now vice president in charge of contracting.

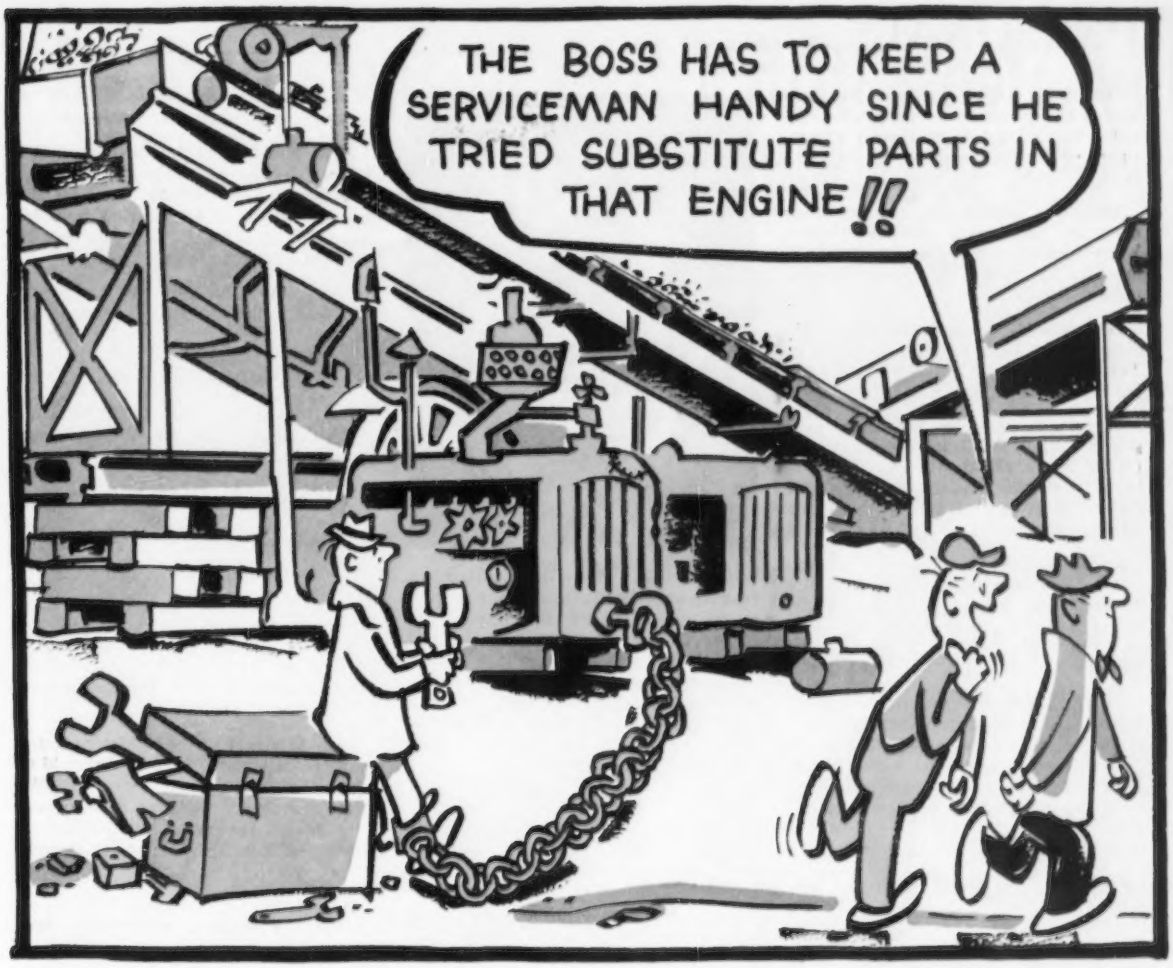
Donald B. Gillies, mining consultant and a former vice president of the Republic Steel Corp., was recently awarded an honorary membership in the Cleveland Engineering Society for his outstanding contributions to the engineering profession dating back to 1893.

Elmer H. Weaver, former vice president of Union Oil Co. of California, has been appointed Commissioner of Emergency Procurement Service of the General Services Administration.

Dr. Franz L. Mayer has been recently transferred from the Tin Processing Corp., Texas City, Tex., as a research engineer, to chief chemist, Chile Exploration Co., Chuquicamata, Chile.

M. L. Urquhart, manager of McIntyre Porcupine Mines, Ltd., has been elected president of the Ontario Mining Association. **M. S. Fotheringham,** president of Steep Rock Iron Mines, was re-elected vice president. Four new directors elected were: **J. M. Cunningham-Dunlop**, president, Nipissing Mines Co., Ltd.; **J. A. H. Paterson,** general manager, Mining Corp. of Canada, Ltd.; **E. A. Perry,** manager, Hollinger Consolidated Gold Mines, Ltd.; and **R. V. Porrit,** director, Pamour Porcupine Mines, Ltd.

William N. Matheson Jr., vice president in charge of sales and planning,



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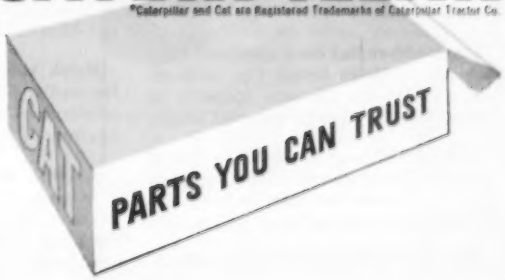

PERSONALS *(Continued)*

Oliver Iron Mining Division, has been named vice president in charge of operations, succeeding **J. E. Machamer** who resigned. Mr. Machamer joined the company in 1930.

Stanislaus Skowronski, research engineer at Anaconda's Raritan Copper Works, International Smelting & Refining Co., has retired. He joined the company in 1912.

Artemois N. Anastassakis, mining engineer from Greece who is inspecting American mines, was on the Lake Superior iron ranges in June.

Howard Evans, mineral processing engineer with Oliver Iron Mining Div. at Duluth, has been transferred to U. S. Steel's Columbia Mining Co. at Cedar City, Utah as supervisor of the beneficiation laboratory.

J. B. Haffner, president of International Oil & Metals Corp. and former president and general manager of the Bunker Hill Co., was awarded an honorary degree of doctor of science by the University of Idaho.

M. L. McRorie, superintendent of Steep Rock's Hogarth mine, has been promoted to general superintendent in charge of all underground mining. **R. S. Andrecheck,** open pit superintendent, has succeeded Mr. McRorie as Hogarth mine superintendent. **J. K. Kervin** has succeeded Mr. Andrecheck.

L. M. Becker, Pickands, Mather & Co., has been transferred as superintendent of the West Hill and Tioga No. 2 mines, to the general office in Duluth where he will be operating assistant.

G. E. Dickens has been named supervisor of personnel for Jones & Laughlin's Minnesota Ore Div., succeeding **R. H. Hanson,** now with Pickands, Mather & Co. in the industrial relations department.

John Kerttu, chief engineer for the Republic Steel Corp. at Lyon Mountain, N. Y., has gone with Alan Wood Steel Co. in New Jersey as assistant superintendent of iron mining operations.

Robert L. Hawkinson, Oliver Iron Mining Div. ore grader, has been named assistant chief grader for the Hibbing-Chisholm district.

Richard Hawkanson has been transferred to Ottawa, Canada where he will be in charge of exploration for Pickands, Mather & Co.

Frank Ebbutt has been appointed chief geologist of Howe Sound Co., with offices in Toronto. He was formerly in charge of exploration for eastern Canada.

Herbert Geittman Jr. has been put in charge of the development effort on castings for the machine tool industry for Climax Molybdenum Co.

Allen T. Cole has established a consulting office in Lakeland, Fla., engaged in exploration, evaluation, mining and processing industrial minerals. Dr. Cole was manager of the Davison Chemical Co.'s Florida phosphate operations and more recently director of atomic energy services for Grace Chemical Research & Development Co.

WILLIAM H. KINNEY has been appointed assistant to the vice president, operations for Kaiser Steel Corp., with offices in the Kaiser Bldg., Oakland, Calif. Mr. Kinney was formerly resident metallurgical engineer for the company. He joined Kaiser Steel in 1948, obtaining wide experience in various metallurgical responsibilities at the company's steel mill at Fontana, Calif.

John M. Kilpatrick has been named general manager of Arcadia Nickel Corp., Ltd. He was formerly general manager of Nickel Rim Mines, Ltd., and prior to that was general manager of MacLeod Cockshutt Gold Mines, Ltd. **John H. Douglas,** formerly associated with International Nickel Co. of Canada, has been named mine manager of Arcadia's Sudbury mine.

Paul D. Littlefield has been elected treasurer of Freeport Sulphur Co. Joining Freeport in 1948, Mr. Littlefield was elected assistant treasurer in January of this year.

Howard C. Brooks has been named geologist at the Baker field office of the State of Oregon Department of Geology and Mineral Industries.

Ralph Adair of the Hassett Mining Co., Burnsville, N. C., has been elected vice president of the Western North Carolina Engineers Club.

Hugh P. Nicholson, associate professor of mining and metallurgy, University of Texas, is spending the summer months in the State of Chihuahua, Mexico, on mine examination and as a consultant for the design and construction of a plant to concentrate Mexican manganese ores.

A. J. Keast, managing director of Rio Tinto Construction & Development Co. in Australia, received the honorary degree of Doctor of Engineering from his Alma Mater, the Michigan College of Mining and Technology.

D. W. Fuerstenau, formerly associate professor, Department of Metallurgy, Massachusetts Institute of Technology, has joined Electro Metallurgical Co. to do research work in mineral dressing.

Dr. John Robert Van Pelt has been appointed to succeed **Dr. Grover C. Dillman** as president of Michigan College of Mining & Technology. Dr. Van Pelt comes to Michigan Tech from the Montana School of Mines where he has been president since 1951. While there he was also director of the Montana Bureau of Mines and Geology.

Fred L. Shanklin has been appointed president of Union Carbide Ore Co., a division of Union Carbide & Carbon Corp., succeeding **F. S. Haggerson** who is resigning for health reasons.

Peru Mining Co., New Mexico Consolidated Mining Co. and Shannon Mining Co. announce the promotion of **J. W. Faust** as manager in charge of all operations. **Joseph H. Taylor** will continue as vice president purely in an advisory capacity.

John A. Peeples has joined the firm of Guggenheim Brothers as a partner. Mr. Peeples is president of the Anglo-Lautaro Nitrate Corp. and has been associated with the Guggenheim mining interests in Chile since 1927.

Louis M. Halper has been elected to succeed **A. E. Hurley** as president of the Pacific Uranium Mines Co.

Dino Pirolo, mining engineer with the Inland Steel Co., has been transferred from the Iron River district to the Armour No. 1 mine at Ironton, Minn.

R. N. Davidson, former division foreman at the New Jersey Zinc Co.'s Eagle Mine at Gilman, Colo., has been named assistant plant manager of International Minerals & Chemical Corp.'s Bondclay and Lawco properties at Jackson, Ohio.

Robert S. Aikens, mining engineer at the general offices of Inland Steel Co., has been transferred to the Sherwood mine at Iron River on the Menominee Range.

Dr. John D. Morgan Jr., has opened a consulting practice in Washington, D. C. He served as mineral expert with the Office of Defense Mobilization.

Nels Koskela, mine captain at Inland Steel Co.'s Bristol mine, has been transferred to the Greenwood mine near Ishpeming on the Marquette Range.

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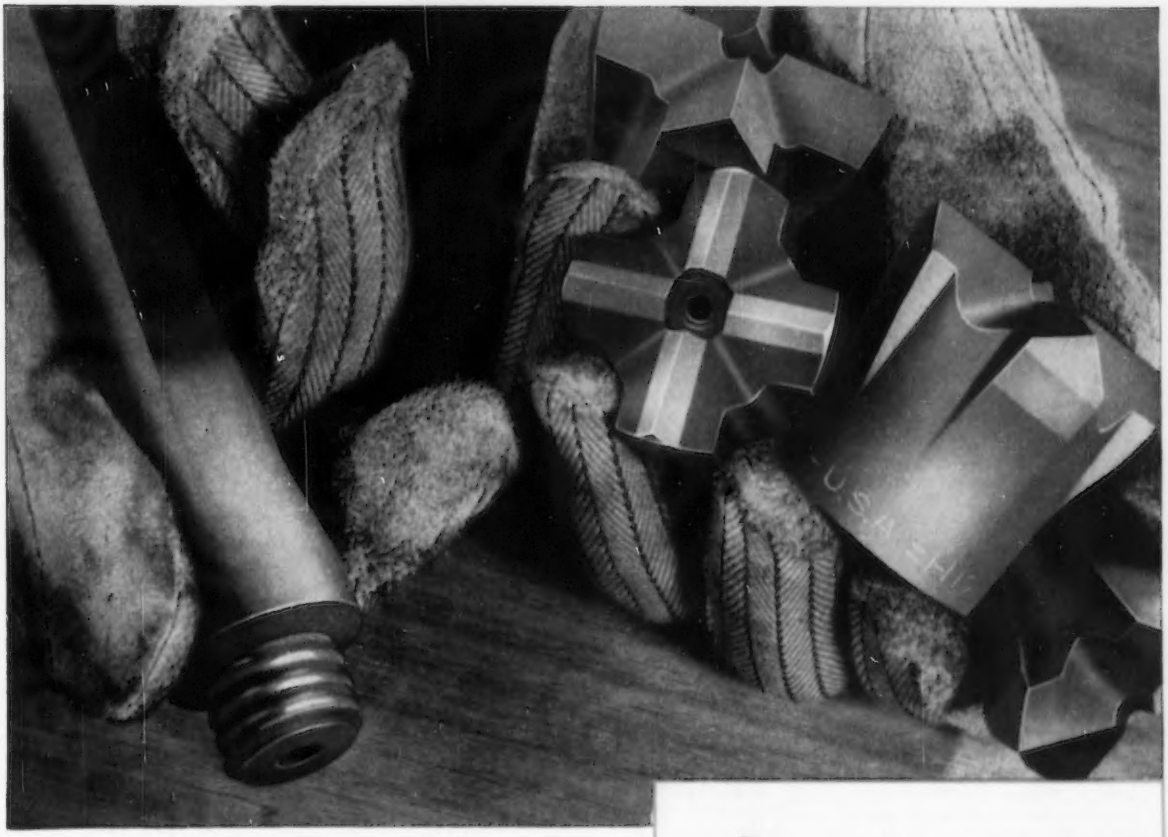

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PERSONALS *(Continued)*

Robert C. Pruess has been elected to the board of directors of Continental Uranium, Inc. He has directed the company's mining and field operations since he was appointed general manager in September 1954.

Paul Dashine was recently promoted from industrial engineering manager to director of engineering for the Calumet Division of Calumet & Hecla, Inc.

William H. Gilman Jr. has joined Foote Mineral Co., Philadelphia, as director of industrial relations.

A. E. Walker, chief geologist for the M. A. Hanna Co. on the Menominee Range, has left for Sao Paulo, Brazil, where he will spend several months in geological work for the company.

Fred T. Jenson, Snyder Mining Co. geologist, is at Butternut, Wis., to make a geophysical survey of 2,280 acres of low grade iron ore lands recently optioned by the company.

D. E. Kivett has been elected president of Utaco Uranium, Inc., succeeding George Burck. He was formerly vice president.

Raymond E. Griffith, vice president in charge of refractory sales and engineering, has retired, but will continue on the board of directors of the company. **Gaylord T. Stowe,** former assistant vice president, has been named vice president and will succeed Mr. Griffith.

Dr. Arthur A. Baker has been appointed associate director for the U. S. Geological Survey. He was administrative geologist since June 1953.

R. C. Wilson is now smelter superintendent with San Manuel Copper Corp., San Manuel, Ariz.

Lyle Hallberg, formerly active in mining operations in Idaho, Montana and Washington, has joined Western Machinery Co. as mineral testing engineer. He is a Metallurgical Engineering graduate of the Montana School of Mines. **Alvaro Cardone,** previously engaged in mining activities in El Salvador, Central America, has joined the company in the ore testing division.

OBITUARIES

ALEXANDER J. McNAB, 78, board chairman of Magma Copper Co. and its subsidiary, San Manuel Copper Corp., died July 4 at a hospital in Rhinebeck, N. Y., after a brief illness. He also was a director of Hudson Bay Mining & Smelting Co., Ltd., the O'Okiep Copper Co., Ltd., of South Africa, the Tsumeb Corp., Ltd., of Southwest Africa and the Newmont Copper Co. of New York. A native of Canada, Mr. McNab was graduated from Queen's College, Kingston, Ont. He worked for a time in a Canadian smelter and entered the U. S. in 1910 to take a mining job at Mason Valley, Nev. In 1915, Mr. McNab joined the Newmont company and became a director in 1931. In 1920 he was named vice president in charge of operations for Magma. Subsequently he became president and was appointed chairman.

Harry Sleeman, 85, one of the early-day mining captains of the Menominee and Marquette Ranges, died in a Milwaukee hospital June 20. He was mining captain at the Forbes mine at Iron River from its opening by the Jones & Laughlin Steel Corp. in 1911, until J. & L. gave up its lease in 1935. North Range Mining Co. took over the property and Captain Sleeman remained until the mine was exhausted in 1940. He was also in charge of North Range's Book mine at Alpha for a time.

David B. Cavan, 70, retired Pickands, Mather & Co. mine superintendent, died at Ironwood, Mich. on May 28. He began work with the company in 1907 at the Elba mine. In 1915 he became superintendent at the Bangor mine. He was transferred to Michigan in 1923 as superintendent of the Penn mines at Vulcan. In 1937 he was named superintendent of the Sunday Lake mine in Wakefield and held that position until his retirement.

James Douglas McClintock, 56, mining executive of Panaminas, Inc., subsidiary of Ventures, Ltd., died July 2 after a 3 month illness. He was Chief of the European and African Branch, Foreign Expansion Div., Defense Minerals Procurement Agency, during the war.

Frederick Lawther Peart, 59, prominent mining engineer, coal and metal mine operator, died in a Denver hospital June 7. He was a member of the Colorado Society of Engineers.

A. J. Walsh, 57, Commissioner of the General Services Administration Emergency Procurement Service, died May 7 at Garfield Hospital after an illness of several months.

Lyttleton Price, 79, with Cyprus Mines Corp. of Los Angeles, Calif., died May 30 after recurrent periods of illness. A mining engineering graduate of the Colorado State School of Mines in 1900, he practiced as mining engineer and conducted mining operations as manager and mine owner throughout his life.

Simon W. Tarr, 82, former chief mechanical engineer with the Oliver Iron Mining Division, died May 11. He joined Oliver in 1902 and retired in 1940.

R. E. Christie, 73, vice president of Crucible Steel Co. of America, died June 27 at New Rochelle, N. Y. Mr. Christie had been associated with the company since 1901, and retired as executive vice president in 1953 and as director this year. He retained the title of vice president. Mr. Christie was also a director of Snyder Mining Co.

NEW BOOKS

Bulletin 1007, Geology of the Uninta River-Brush Creek Area, Duchesne and Uintah Counties, Utah, by Douglas M. Kinney. Maps and 180 pp. Price $3.50.

Bulletin 1009-J, Criteria for Outlining Areas Favorable for Uranium Deposits in Parts of Colorado and Utah, by E. J. McKay. Most favorable ground in the area is lenticular sandstone where stratum is underlain by continuous altered greenish-grey mudstone. Map and 17 pp. Price 55c.

Bulletin 1009-I, Carnotite-Bearing Sandstone in Cedar Canyon, Slim Buttes, Harding County, South Dakota, by James R. Gill and George W. Moore. Carnotite-bearing sandstone and claystone have been found in Chadron formation of White River group in Oligocene Age on the Southern part of Slim Buttes. Locally sandstone contains 0.23% U_3O_8. Map and 15 pp. Price 35c.

Bulletin 1024-C, Radioactivity Investigations at Ear Mountain, Seward Peninsula, Alaska, 1955, by P. L. Killen and R. J. Ordway. 33 pp. Price 40c.

Bulletin 1027-C, Dolomite Deposits Near Marble, Stevens County, Washington, by Charles Deiss. Deposit discussed is accessible for open-pit mining. Deposit averages 2½% impurities in fine crystalline, massive, thick-bedded dolomite. Map and 22 pp. Price unknown.

Motion Pictures

Million Dollar Drill Hole, by Utex Exploration Co. This 30-minute, 16 mm film is available to any group interested without cost. Please address requests to Charles A. Steen, president Moab Drilling, Moab, Utah. Please furnish three alternate dates so that the company can select one to fit its schedule.

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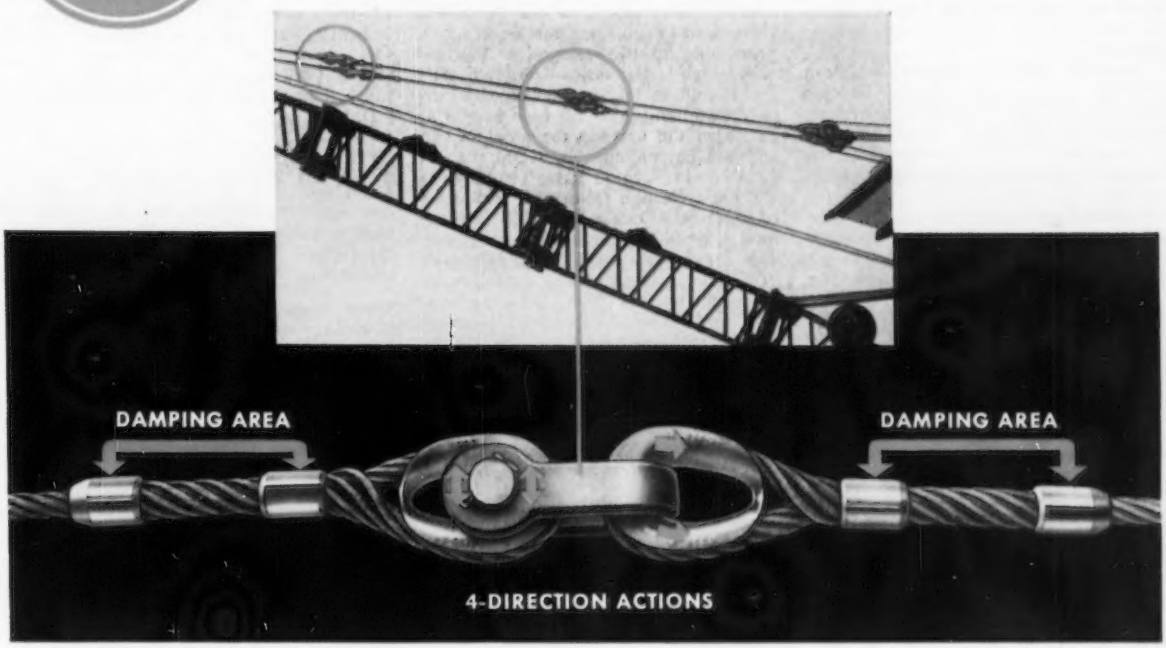

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Better Value

Congress Winds Up An Active Session

HERE IS A CHECKLIST of what Congress did this session that affects the mining industry:

Domestic Minerals Purchase—After a two-year battle with Office of Defense Mobilization and Interior Department, mining-state legislators pushed through a temporary, stop-gap extension of the Domestic Minerals Purchasing Program to Dec. 31, 1958. The bill, which the President signed just before this issue went to press, covers those minerals which ODM feels it can no longer justifiably purchase on defense grounds:

Tungsten — 1¼-million-ton units at $55, with a 5,000-ton unit limit on what the Government may buy from any one producer in any single month; asbestos—2,000 tons of No. 1 and 2, and an additional 2,000 tons of No. 3 if delivered along with the others, at the current General Services Administration price of $1,500 for No. 1 and $900 for No. 2; acid-grade fluorspar—250,000 tons at $53, payable at the milling point; columbium-tantalum — 250,000 lb, at GSA market price ranging from $1.40 to $3.50, depending on grade (this program, however, is merely insurance to producers, as the ODM stockpile goal is filled and Government plans no new purchases).

Bill also provides that Interior Department take over responsibility for the purchase programs for ODM, since they are justified on the basis of supporting a firm domestic productive capacity rather than on defense needs. The program will cost about $91-million, to be appropriated directly by Congress, instead of coming out of Defense Production Act funds as the ODM programs have been paid for.

The stopgap compromise stemmed from Senate Interior Committee's full scale investigation of the state of the domestic mining industry, which also led to an Administration promise to set up a long-range domestic minerals policy under Interior to support U. S. producers.

The bill was limited somewhat in the House, which placed the tungsten ceiling for any one producer and knocked out a bonus price of $63 for small producers.

Meanwhile, ODM director Arthur S. Flemming promised to continue other domestic purchases under his executive jurisdiction. So far he has extended the program for metallurgical chromite to June 30, 1959; muscovite block and film mica to Jan. 30, 1962; metallurgical grade manganese to Jan. 1, 1961; and beryl to June 30, 1962. He also has stepped up stockpile goals for high-grade manganese (from 19-million to 28-million long-ton units) and beryl (from 1,500 tons to 4,500 tons). Similar relief is in the works for metallurgical grade fluorspar, antimony and mercury.

Senate also passed a bill to extend Government manganese purchases, which now fall into two categories. The so-called high-grade, carload program calls for 19-million long-ton units, of which only 6-million units have been bought at $2.30 per ton unit—so the program can and will be continued by ODM past its June 30, 1958 cutoff date. The other is a depot collection from small producers of lower-grade manganese, which has almost reached its 18-million ton unit goal. The Senate bill, passed over objections of Eastern processors and producers of other minerals not offered the same help, calls for a continuation of the program up to 30-million tons units. The House, however, did not have time to act on this bill before adjournment.

A similar bill for an Alaskan tin purchase program of 10,000 long tons at $1.20 to $1.35 per lb suffered the same fate.

Barter—CGC doubled Agriculture Department's authority to barter farm surpluses overseas for minerals—but ODM assured industry this would not interfere with domestic support purchases or its announced Buy-American policy. These materials will go into a supplemental stockpile, frozen by Congressional edict. New lead and zinc barter deals were consummated.

Public lands—House okayed a 5,000-acre limit on any military withdrawal of Public Lands, but few mining claims are involved. House also placed a new limit of 6,400 acres on phosphate lease lands—up from 5,000 acres—within any one state, but only 10% of phosphate production is affected, since the bulk is on private lands.

Government officials—Congress okayed former Sen. Fred Seaton of Nebraska as Secretary of the Interior and Marling Ankeny as director of Bureau of Mines, delayed approval of ex-Congressman Wesley D'Ewart as Under Interior Secretary in charge of Public Lands.

Off-highway vehicles—Administration's new highway gasoline tax bill puts new 1c tariff on all gasoline for vehicles, including mining trucks used in open-pit operations. But this can be rebated if these vehicles aren't licensed or used for highway traffic.

"Politics" — House Democrats charged "giveaway" of Oregon timber forests to Al Sarena Mining Co. and mishandling of Government's Nicaro, Cuba nickel plant expansion—but Republicans dismissed these reports as politics.

Tariffs—U. S. negotiators at GATT Geneva Conference made 15% reduction on some iron, and steel forms, tariff exemptions on scarce scrap and aluminum materials were extended. Liberal traders in Senate warned against misuse of "defense essentiality" clause as means of raising tariff barriers, but did not prejudge fluorspar hearings pending before ODM.

Nickel storage—Several Congressional committees probed shortages of nickel and alleged gray market prices, authorized tighter Government allocation controls in amendment to the extension of the Defense Production Act. But ODM said it won't use them.

Silver repeal—Annual move to repeal Silver Act was again pigeonholed.

Texas City tin smelter—Congress approved its continuation through January 1957, at which time it is to be sold to private industry. This news cheered foreign miners.

GSA Lists Minerals For Purchase Plan

GENERAL SERVICES ADMINISTRATION put out its second public "shopping list," an itemization of the metals and minerals it can buy under Office of Defense Mobilization authority. The purchases go into three national stockpiles — emergency short-term, long-range and supplemental.

New list, which runs through June 30, 1957 is essentially the same as GSA's first publicly-announced list last May. There are three significant changes, however, in buying policy for aluminum, copper and nickel.

All aluminum goals are closed, so no further Government purchases will be authorized. Copper supply is just now exceeding demand, and Government stockpile orders are only beginning to come in. So ODM is working out a delayed schedule for the delivery of previously diverted orders, and GSA will not buy any copper except for the emergency short-range stockpile. The same applies to nickel, where all Government buys are being diverted because of the tight market shortage.

The list follows:

For the long-range stockpile—Antimony, amosite asbestos, metallurgical chromite, bort diamonds, metallurgical fluorspar, lead, magnesium, battery-type synthetic dioxide manganese, chemical types A and B maganese, muscovite block and film mica, phlogopite splittings mica, selenium, silicon carbide, steatite block talc and zinc.

For the short-range stockpile—Jamaica bauxite, beryl, metallurgical chromite, cobalt, copper, battery-grade synthetic dioxide manganese, metallurgical manganese, muscovite mica block, molybdenum, nickel, tin and zinc.

For the supplemental stockpile, including materials acquired by barter for agricultural surpluses—crude aluminum oxide abrasives, antimony, amosite and chrysolite asbestos, Jamaica bauxite, Surinam bauxite, refractory bauxite, beryl ore, bismuth, cadmium, metallurgical and refractory chromite, industrial diamonds, Ceylon graphite, lead, magnesium, battery-type synthetic dioxide manganese, chemical types A and B manganese, metallurgical manganese including ferromanganese and electrolytic manganese, muscovite mica block, film, and splittings, phlogopite mica splittings, quartz crystals, crude silicon carbide, steatite block talc, titanium and zinc.

ODM repeated its previous policy of "Buying American" wherever possible.

Amortization Ruling

LATEST EXPANSION GOAL list released by ODM shows eight mining projects which may still get fast tax amortization. They are chemical grade chromite, copper, battery and chemical grade manganese, mercury, nickel, rutile, selenium and substitutes for strategic natural mica.

Others may be reopened, however, ODM director Flemming has indicated strongly that such high-temperature metals as titanium may get new expansion goals shortly.

ODM Staff Moves

ODM STAFF SHUFFLE—Office of Defense Mobilization has shuffled its organizational structure, dropping two posts and creating two new ones. Its office of materials and office of production will be combined into a new office of production, to be headed by Pennsylvania Salt Mfg. Co.'s president George B. Beitzel. This office will cover the areas previously handled by Chester Ogden (materials) and George A. Landry (production). Ogden returns to Detroit Edison Co., Landry moves to ODM's transportation division. New chief of plans and readiness is retired Marine Lt. Gen. Merwyn H. Silverthorn.

Forest Law Widened

IN LATE July the House of Representatives sent legislation to the White House to broaden the law on use of national forest lands for a number of special purposes including mining.

Law is specifically directed to allow the leasing of up to 80 acres by hotel or resort operators. Only five acres can now be leased.

For the first time, the same provision would be extended to industrial or commercial uses "related to or consistent with" the purpose of national forests, including such things as mining camps, saw mills, warehouses, etc.

John C. L. Donaldson

Labor This Month

MINE-MILL RIDES HIGH: A year that began with some ominous signs for the Mine-Mill and Smelter Workers Union has turned into one of its most successful periods. The threats that loomed on several fronts at the start of 1956 either failed to develop or were knocked down by the mine union. At this point, MMSW is batting almost 1,000.

Mine-Mill's successes came at a time when speculation was ripe on a possible breakup of the union. Instead of disbanding, MMSW is running out the year in better shape than it could boast in a long time. Here's how the union fared in three fields that could have been troublesome:

COLLECTIVE BARGAINING—At the same time the related steel industry was embroiled in a tight strike, the non-ferrous industry and Mine-Mill signed three-year contracts. All major negotiations came without trouble and both sides earned a much sought-after measure of stability provided in the long-term pacts. For Mine-Mill, the lengthy agreements ease the potential raiding threats of the AFL-CIO steelworkers union. And the benefits provided in the new contracts, the union estimates, mean about $1,500 per worker over the three-year period.

UNION RIVALRY—The perpetual battle between Mine-Mill and rival unions over representation rights in non-ferrous metals closed the latest rounds with an MMSW victory. Mine-Mill tagged the steelworkers union with a new defeat—for the fourth time—at the big Anaconda company in Montana, winning by a lop-sided vote of 1,302 for Mine-Mill to 830 for the steel union. With the new three year contract in their pockets, on top of the new setback to the steel union, Mine-Mill officials are predicting the AFL-CIO affiliate won't attempt another election during the life of the contract.

This latest representation victory, say Mine-Mill leaders, is the tenth in the last 12 election skirmishes with AFL-CIO unions. The only defeats were at Butte, where Mine-Mill lost stationary engineers to the AFL-CIO operating engineers and in the Kennecott mill at Hayden, Arizona.

FEDERAL TROUBLES—The Government's proposed crackdown on Mine-Mill as an alleged Communist-infiltrated organization has slowed to a walk. The Justice Department's case against the union before the subversive activities control board is still not completed. Results from the Government charges of Communist-infiltration against Mine-Mill are not on the horizon. With the first legal tests threatening to linger through the rest of the year, the final court actions won't be reached for at least several years. Thus, Mine-Mill's immediate future looks quiet; a period its officers will use to re-coup the loose ends that had developed during recent years.

STRIKE HELP—With tongue-in-cheek: Mine-Mill's well-publicized offer of aid to the striking Steelworkers Union most likely had its lighter moments. With the sharp rivalry between the two unions as strong as ever, it's questionable whether the offer-to-help telegram from MMSW president John Clark to Steel Union chieftain David McDonald meant just what it said. "Please feel free to call upon Mine-Mill for whatever active and moral support may be necessary," said Clark, in the Steel Union's strike against the basic steel industry.

But, whether Clark really meant it or not, there's no question about the outcome. McDonald wouldn't take up the offer.

LONG-RANGE EMPLOYMENT FALLS: Latest Government figures show the extent of the employment decline in the non-ferrous metals industry. All three mining industries—copper, metal and iron and zinc—show a fairly sizable fall-off from peak World War II job total records. Here's the breakdown:

Copper mining employed 23,300 workers in 1954, compared with 25,000 in 1939 and a peak of 34,000 in 1942.

Iron mining employment was 30,500 in 1954, a 5,000 decline from a year earlier but 9,000 above 1939.

Lead and zinc mining employment totalled 13,700 in 1954, compared with a 1943 wartime record of 23,000 and a 1939 total of 16,000.

 (*Continued from p 73*)

Atomic Energy Conference Gets Output Figures

URANIUM PRODUCTION FIGURES previously guarded as top secrets were announced publicly by Dr. Jesse C. Johnson, director of raw materials for the AEC, at the National Atomic Energy Conference held in Denver in late June.

Dr. Johnson disclosed that:

1. The U. S. now is producing uranium at a rate of nearly 3-million tons per year.

2. The U. S. has indicated and inferred ore reserves in excess of 30-million tons, with potential reserves of an additional 30-million.

3. In 1948, known U. S. reserves were only 1-million tons, and production that year was only 70,000 tons.

4. U. S. uranium production is expected to reach 5- to 6-million tons annually, in the future.

5. Free World reserves of uranium ore are estimated to be equivalent to 1-million tons of uranium concentrate, and may be twice that.

6. Completion of projects under way or planned should give the Free World annual production in excess of 30,000 tons of concentrates in years to come.

Johnson earlier had been quoted as placing Colorado Plateau production at 1.5-million tons annually. He explained that he was referring in that figure to ore moved by trucks, and did not include ores moved by rail (such as that from Anaconda Mining Co. property in New Mexico) nor an unforeseen increase in over-all production.

The Atomic Energy Conference, sponsored by the Atomic Industrial Forum and Denver Research Institute, drew a total registration of nearly 250. Two days of lectures in Denver were followed by a field trip to uranium mines and mills near Moab, Utah, and Grand Junction.

John B. Knaebel, manager of the Anaconda Co's Jackpile uranium mine in New Mexico, declared at the Denver conference that uranium is becoming increasingly harder to find and expensive to produce.

"If uranium is not displaced as a source of nuclear energy for industry," he said, "an ore price increase is going to be needed to stimulate exploration and production."

Another top official of the Atomic Energy Commission said it's looking for an industrial firm interested in reprocessing cold uranium fuel scrap, which is now going to waste.

Charles G. Manly, chief of the policy and program branch of the division of civilian application of the AEC in Washington, said the business would require a capital investment of about a half million dollars.

Manly told Conference participants that he was puzzled at industry's disinterest in getting into atomic energy business.

"There seems to be a common misunderstanding in the industry to the effect that you cannot get into the atomic energy business unless and until the AEC puts out a special invitation. Nothing could be further from the truth.

"Opportunities to get into this business are all around you—all you have to do is seize them. What you have to do is provide the initiative and find a niche for yourself."

Besides reprocessing of cold uranium fuel scrap, other areas of the industry now wide open, Manly said, include:

1. Disposal of radioactive waste products which come out of atomic reactors.

2. The reprocessing of fuel elements from reactors.

3. The manufacture of uranium metal from uranium concentrates.

Rattlesnake Pit's Orebody Is Readied

OPEN PIT work is well under way at Continental Uranium, Inc.'s Rattlesnake property near La Sal, Utah, from which about 2.5-million yd overburden now has been excavated. Company officials say about one-third of orebody is exposed and ready for mining. Continental holds contract with AEC for purchase of concentrates from $2.5-million mill company proposes to build near La Sal to handle ore from Rattlesnake and Continental No 1. However, Continental now says it is withholding start of construction pending final decision by Floyd Odlum's Ute Milling Co. on whether it will build a mill in the Big Indian district nearby. Should Ute Milling Co. obtain contract with AEC, Continental implies it will not go ahead with its mill construction plans.

Brunswick's Reserves

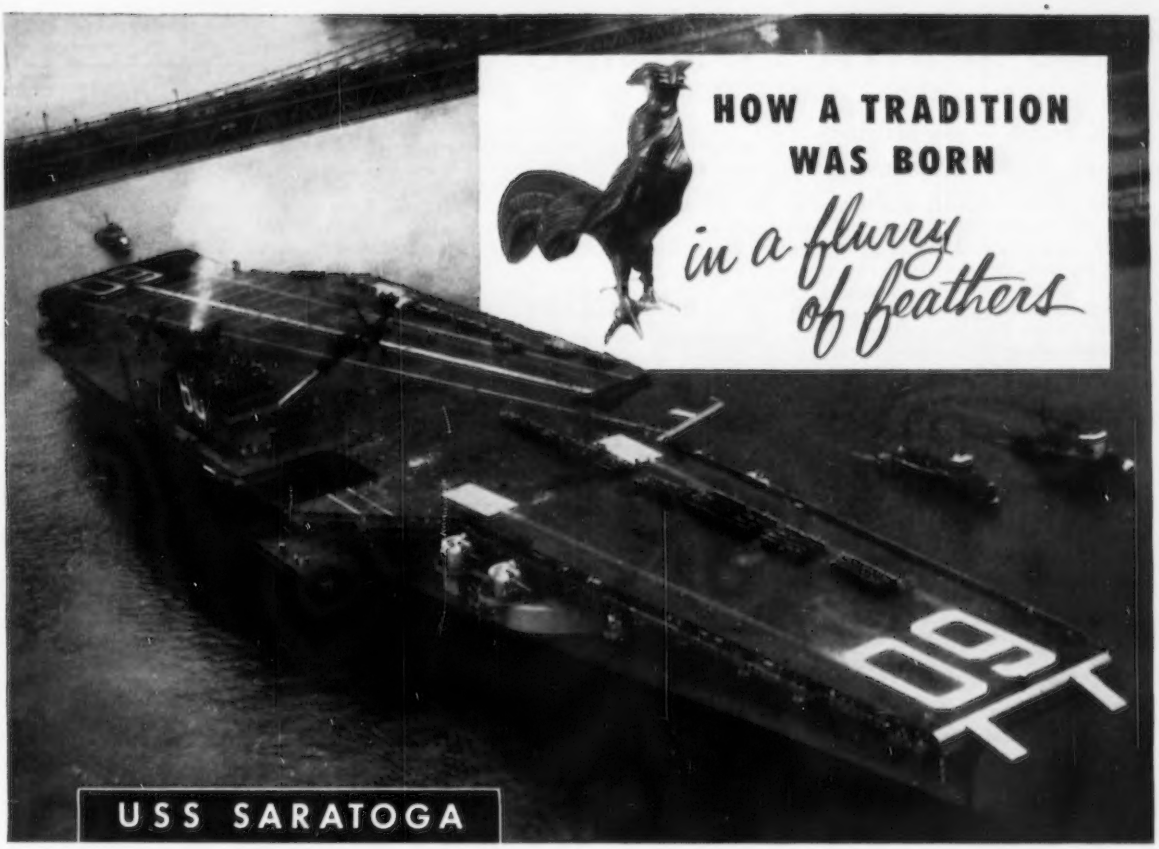
"UPWARDS OF 60-MILLION TONS of ore has been proven" at Brunswick Mining and Smelting Corp.'s holdings at Bathurst, New Brunswick, according to discussions carried on at the 92nd annual stock holders' meeting of the St. Joseph Lead Co.

Lawrason Riggs, resident manager, told the audience that the ore averaged some 6½% combined lead and zinc, and that while mining would be simple, milling would be difficult.

New Leadville Plans

NEWMONT MINING CORP. and AS&R will operate the revamped Resurrection mill and their other properties in the Leadville, Colo. area as a single unit, managed by Resurrection.

Decision to revise operating procedure was based on a review of the completed exploration of the Irene and Iowa Gulch areas. Resurrection mill was closed down in February for modernization and improvement of efficiency. Output will now be about 400-tpd. All exploration work has been halted, local sources say, and current efforts are confined to preparing the known ore for mining.



The symbol, and the spirit, of the fighting gamecock lives on with the commissioning of the powerful aircraft carrier, *USS Saratoga*.

The incident which gave birth to this 142 year old Navy tradition took place on the decks of the first *Saratoga* as she closed for action against four men-o'-war in 1812. In the opening minutes of the engagement an enemy ball landed on deck – crashing into a coop containing a gamecock brought aboard by a sailor.

With a flurry of feathers, the startled bird flew to the rail and, as if expressing his personal indignation, crowed lustily and defiantly. Taking this as an omen of good luck, the outnumbered and outgunned American ship entered the battle with new courage and completely won the day.

The Navy's newest aircraft carrier is the fourth ship to bear the name *Saratoga* and adopt its fighting symbol. As aboard its sister aircraft carriers, the USS Forrestal, USS Independence*, and USS Ranger*, Walworth Valves and Fittings are installed. We are proud of the many contributions that our products and engineering skills have made to these outstanding vessels.

Walworth products installed aboard these ships include Pressure-Seal Cast Steel Gate, Globe, and Angle Valves, Fabricated Cast Steel Manifold Valves, Cast Steel Y-Globe and Angle Valves, Bronze Gate, Globe, Angle, and Check Valves and thousands of Walworth pipe fittings including Walseal® Fittings, Flanges, and Unions.

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THIS MONTH IN MINING *(Continued)*

U.S. Firm Wins Mining Grant from Bolivia

SOUTH AMERICAN Gold and Platinum Co., via negotiations completed last month, has received the first mining grant to a U.S. company by Bolivia since the expropriation of foreign mining properties there in 1952.

The 25-year concession covers an undeveloped placer gold mining area, embracing parts of four river valleys in the State of Beni, north central Bolivia. Exploration is to start in early October. Louis B. Harder, president of the U.S. firm, said his company had received "assurances" from the government of Bolivia. Harder also said his organization had made an offer to purchase control of Frontino Gold Mines, Ltd., a British company that owns the largest underground gold mine in Colombia.

Bolivian private industry has also been receiving government encouragement, with promise of financial aid and other support by various agencies, including Banco Minero de Bolivia.

Bureau of Mines Names Safety Award Winners

WINNERS OF AWARDS during the USBM's 31st National Safety Competition included the following mining properties:

Zenith iron mine of Pickands, Mather & Co., operated by Vermillion Mining Co., Ely, Minn., which worked 529,373 man-hours without a disabling injury. Zenith also won the trophy in 1935 and in 1954.

Erie Commercial iron mine, PM&Co., operated by Erie Mining Co., Aurora, Minn., which worked 558,010 man-hours without a disabling injury.

Bell limestone mine, an underground operation owned by the Warner Co., Bellefonte, Pa., made 264,075 hours. Bell mine has received five previous honorable mentions in the USBM competitions, this is its first trophy award.

Hillsville limestone quarry, U. S. Steel Corp.'s Michigan Limestone Div., Hillsville, Pa., worked 400,053 man-hours; was a trophy winner in 1952.

Mining Calendar

International Geological Congress, 20th Session. Mexico, D. F., Sept. 4-11.

Rocky Mountain Minerals Conference, third annual session, AIME, Salt Lake City, Utah., Sept. 26-28.

German Society of Metallurgy and Mining, general assembly. Klagenfurt, Austria, Sept. 26-29.

American Congress on Surveying and Mapping and American Society of Photogrammetry. Denver, Sept. 30.

National Electronics Conference, Hotel Sherman, Chicago, Ill., Oct. 1-3.

American Mining Congress Mining Show, Shrine Exposition Hall. Los Angeles, Calif., Oct. 1-5.

Fifth National Clay Conference, University of Illinois. Urbana, Ill., Oct. 8-10.

Sixth annual Drilling Symposium, University of Minnesota. Minneapolis, Oct. 11-13.

44th National Safety Congress. Chicago, Ill., Oct. 22-26.

Society of Exploration Geophysicists, 26th annual meeting. New Orleans, La., Oct. 25-Nov. 1.

New Mexico Mining Assn. and International Mining Assn. Carlsbad, N. M., Nov. 1-3.

Northeastern Branch conference, AIME. Hershey, Pa., Nov. 8-10.

American Society for Metals, second world metallurgical conference. Cleveland, Ohio, November.

Mining-Chemical Inter-Industry Conference, sponsored by San Francisco Chamber of Commerce. Fairmont Hotel, Nov. 9.

Drilling Symposium Will Feature Production Work

A BROADER BASE of study is included in the sixth annual Drilling and Blasting Symposium of the University of Minnesota, to be held at Minneapolis Oct. 11-13. This year, the famous discussion sessions will be devoted to production drilling and blasting instead of the previous standard subject of exploration drilling.

Symposium officials note that the probable subject matter next year will again be exploration drilling problems, and that the two general subjects will alternate in future years.

Program subjects scheduled so far will consist of discussion of the principles of drilling and blasting on Thursday, Oct. 11; the following day will be devoted to drilling and blasting practice in the Lake Superior area, with suggestive practice elsewhere. Saturday morning will be spent in the regular open discussion. Symposium will be held at the Center for Continuation Study on the Minneapolis Campus of the University. Accommodations are available at the Center.

IM&CC Inaugurates Three New Mineral Operations

A MICA BENEFICIATION plant in Tennessee, a nepheline syenite producer in Ontario, and a perlite grinding unit in California are the three latest additions to the diversified list of operations of International Minerals and Chemical Corp. Mica-containing silt which has accumulated since 1910 behind a TVA dam is the raw material for the $1.5-million plant at Greeneville, Tenn. which will produce 64 tpd at capacity. New methods were devised to gain the mineral from the thick silt.

Blue Mountain, Ont. is the site of a $1.5-million nepheline syenite operation, with annual capacity of 100,000 tons. Product is a low iron, high alkali, high aluminum material important in glassmaking. The perlite grinding facility in Los Angeles, only recently opened, will be doubled in the near future, according to Louis M. Ware, company president.

Davison Chemical Processes AEC's Monazite

FOR THE NEXT 18 MONTHS or so, the new $2-million monazite processing plant of Davison Chemical Co., division of W. R. Grace & Co., will be working on the monazite accumulated in the Government stockpile. The new 15- to 25-tpd plant at Curtis Bay, Md., will ship the thorium oxide to AEC and the mixed rare earths back to the stockpile.

In the opening ceremony, Raff Faulkner, assistant director, division of raw materials, U. S. Atomic Energy Commission, stated that the thorium oxide may be used: (1) in the second aqueous homogeneous reactor at Oak Ridge, which will use a uranyl sulphate solution in heavy water as core fuel. Later the thorium oxide slurry addition will be attempted; (2) or a third reactor may be built specifically designed for thorium oxide blanket; (3) or the graphite moderated sodium cooled reactor developed by North American Aviation might use a thorium core; and (4) the single region slurry-type homogeneous reactor now being built by Pennsylvania Power & Light and Westinghouse Electric Corp may use thorium oxide slurry dispersed in the uranyl sulphate core.

In addition, there is another type reactor that can use thorium. This is the thorium-bismuth blanket in which the fuels are metals and not oxide salts as in the cases above.

Davison's new plant will produce rare earth oxides, fluorides and sulphates as well as cerium and thorium compounds.

Monazite will be ball-milled, weighed, then decomposed in sulphuric acid in batch reactors.

Plant will be integrated with Davison's sulphuric acid plants at Curtis Bay and the phosphoric (monazite by-product) acid activities of the company.

Phelps Dodge, IUMMSW Sign 3-Year Labor Pact

PHELPS DODGE CORP. and the International Union of Mine, Mill and Smelter Workers have announced the signing of a three-year labor contract. The arrangement covers employees represented by the union in Phelps Dodge operations in the Morenci, Bisbee and Douglas area. The new contract will expire July 1, 1959.

Wages will be increased in the first year in amounts that will average 10.1c per hour; in the second year, 7.1c per hour; and in the third year, 7.1c per

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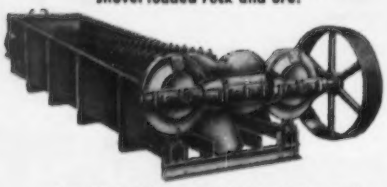
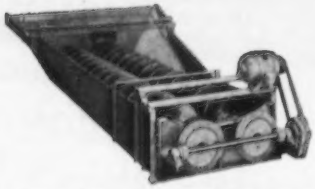
All Steel Rockmaster Single Roll Crusher for primary or secondary work on shovel loaded rock and ore.

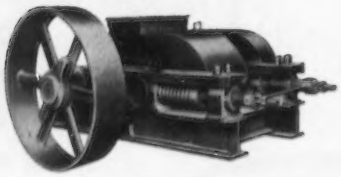
Heavy Duty Reciprocating Plate Feeder. Handles any materials from sand sizes to shovel loaded rock and ore.



Log Washer for removing tough clay and soft rock from various materials.



Double Screw Washer (with gear cover removed), for dewatering, classifying and removing waste from sand, limestone and other materials.



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P-D Signs *(Continued)*

hour. A new and improved pension plan has also been agreed upon whereby eligible pensioners will receive $2.25 per month for each year of service with the corporation up to 30 years in addition to Social Security. The plan also provides for a disability pension of $80 per month, early retirement at age 60, and vested rights for qualifying employees between the ages of 40 and 60 years.

Health and welfare benefits were also improved whereby additional hospital, X-ray and laboratory services will be provided for all employees and their families. The company and union spokesmen stated that the contract should provide for economic stability for the employees, their families, and the community for a three-year period.

A statement by Orville Larson, vice president of the Mine, Mill and Smelter Workers' Union with headquarters at Miami, Arizona, in Denver said:

"We feel that the new agreement will bring stability to Arizona for the next three years and will eliminate the annual crisis and threat of strikes. The workers, the company and the community can now make definite plans for three years."

Agreements between the other major producers of copper in the U. S. and the union were reached in July, with similar contract points.

AEC Buys Japanese Zr

A "ONE-SHOT" DEAL to purchase zirconium from Japan was announced by the U.S. Atomic Energy Commission in mid-July. AEC spokesmen said the Commodity Credit Corp. was taking 200,000 lb Zr in exchange for surplus agricultural commodities valued at $2.4-million. Purchase was made, observers believe, to tide the agency's operations over until production is received from three new plants (E&MJ, June 1956, p 133).

IN THE U.S.

ALASKA

W. S. Pekovich of Admiralty Alaska Gold Mining Co. has announced an accelerated exploration program at the Funter Bay nickel-copper lode to be started when new equipment arrives and the required labor is available. Now on order are two battery locomotives, two mucking machines, ten 2-ton cars, compressors and other necessary items. Negotiations are in progress with two exploration firms to furnish crews for the work.

A minimum of 4,000 ft of drifting is to be done in extending an existing drift at the 200-ft elevation and driving a new drift at the 1,000-ft elevation. Exploration done to date has been at the 1,425- and 1,700-ft elevations. Both of the proposed openings are expected to intersect the orebody.

Pekovich states that this new program is definitely looking toward actual pro-

This view, showing a specimen of an etched cross section of a molybdenum ingot, was furnished by Climax Molybdenum Co., who now use a 60" Symons Primary Crusher, 12 Symons Cone Crushers, and 25 Symons Vibrating Rod Deck Screens.

• MOLYBDENUM, from the Greek "*molybdos*", meaning lead, is popularly referred to as "moly", and has its main commercial source in the mineral molybdenite. Increasing production of molybdenum has been essential for the manufacture of alloy steels used extensively in aircraft, automotive, heavy machinery, and many other industries.

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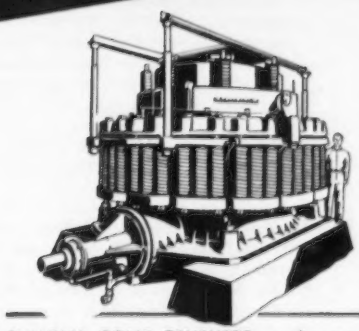

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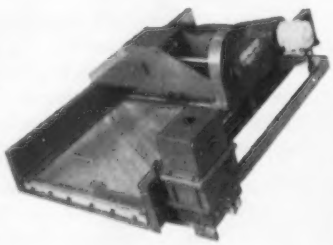

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Alaska *(Continued)*

duction. Diamond drilling will continue.

USSR & M Co. has brought in a construction crew of 70 men from the Yuba Consolidated Co. to rebuild the dredge that capsized in the spring of 1953.

A limestone deposit which Aluminum Co. of America had planned to develop in conjunction with a proposed aluminum plant in Alaska has been leased to the Edna Bay Pure Stone Co., owned by Kent B. Diehl Sr. of Orange, Tex., and Cullen F. McDougal of Dallas.

Plans for the aluminum plant apparently have been shelved, following rejection by the Canadian Government of Alcoa plans for river diversions required to develop the necessary hydroelectric power.

The limestone now will be quarried and shipped to a $5-million lime plant the Texas-owned company will build next year at Vancouver, Wash., near an Alcoa reduction plant.

Management of Alaska Juneau Gold Mining Co. was unseated by a stockholders group headed by Charles J. Ver Halen Jr., Los Angeles, at the company's annual meeting in San Francisco, June 5.

Ver Halen, president of Ver Halen Publishing Co., Film Service Laboratories Corp. and California Stucco Co., was one of four new directors elected to the seven-man board by the "stockholders action committee."

In its proxy battle, the stockholders committee charged the old management with failure to meet operating expenses, declare a dividend, or increase assets for 12 years, and promised to revitalize the company.

Spokesman said that negotiations were proceeding in perhaps "half a dozen different directions" with a view toward diversifying the company and acquiring earning properties. He said that, in view of the price of gold, it was unlikely that the company's gold mine in Juneau would be reactivated.

Territorial Department of Mines reports that small deposits of barite are widespread in Alaska, but there is only one known deposit of commercial possibilities at the present time. This is on one of the Castle islands in Duncan Canal and is estimated to contain 50,000 tons of 90% barite above high tide. It is on patented ground and held by the Alaska Juneau Gold Mining Co.

Senate Bill 2648, approved by the Senate Committee on Interior and Insular Affairs July 10, is expected to give a shot in the arm to tin mining in Alaska.

Under provisions of the proposed law the Government would establish a purchasing depot in Seattle to buy domestic metallic tin at a set price above the world price. Domestic means Alaskan tin since a hard-pressed venture on Alaska's Seward Peninsula is the only tin mine under the American flag. To date, competition from foreign tin has prevented any large scale development of the resource. Alaska has produced about 2,000 tons of tin despite high operating

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Dispatcher sends orders instantly and simultaneously to all motormen with this modern, underground two-way voice communication system. Motormen receive and reply while trips are in motion—keep haulage movements coordinated with production demands. This results in smoother, faster, and more continuous trip movements throughout the mine.

Messages clear tracks for outgoing loaded trips and incoming empties. This system puts an end to traffic tie-ups, errors and accidents; prevents excessive stop-and-start strain on equipment. Write for more detailed information.

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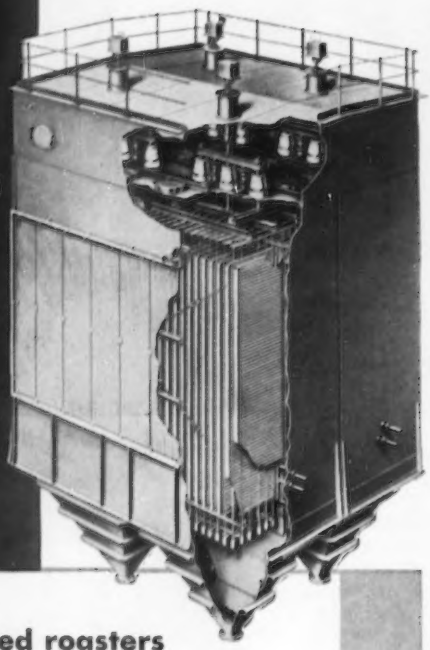

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Alaska *(Continued)*

costs and expensive shipping outlay.

A new and encouraging trend in Alaska's mining industry was outlined at a meeting of Alaska and Northwest bankers in Anchorage in early July. Phil Holdsworth, director of Alaska's Department of Mines, told the Alaska Bankers' Association that copper, coal and iron hold greatest promise of development in the resurgence of the industry. He said the rich Chitina copper area, site of the once-fabulous Kennecott mine, is being explored again by Kennecott on a full season basis, with hopes of relocating a new copper formation.

Holdsworth also said prospects for the vast southeast Alaska iron deposits have improved since Japanese steel makers recently increased their specifications to allow 3% titanium in iron ore, making mining of the Alaska deposits feasible.

Union Carbide Nuclear, which has signed a contract for the I & L uranium property on Prince of Wales island off Ketchikan, is now endeavoring to clear title to the claims. If successful, they plan a drilling program this year.

I & L is adjacent to the original Ross-Adams discovery on Prince of Wales Island, the only major uranium strike of commercial nature to date in the territory. Climax Molybdenum Co., which is developing the Ross-Adams claims, plans to ship its first load of ore this summer.

ARIZONA

A spectacular explosion June 12 of 41,000 lb of blasting powder blew the top off Emperor Hill at Ray, and broke up an estimated 200,000 tons of material on an isolated high point towering above Kennecott Copper Corp.'s Pearl Handle open pit mine.

The expanding pit and two others to the south and west gradually have surrounded the hill, formerly the site of the town's water tanks.

Emperor Hill loomed 900 ft above the surrounding valley that contains Ray and could not be handled by machinery and small blasts. Kennecott officials blew the cap with one big explosion before starting normal leveling work.

It was termed the largest concentrated explosion ever attempted by the Ray Division.

The work is part of Kennecott's $40-million expansion program launched by the Ray Division this spring.

The undertaking is expected to reach its peak in 1958 with completion of a smelter in Hayden which will result in a 20,000-ton annual increase in copper production.

Besides leveling the surrounding hills as its Pearl Handle Pit Mine expands, Kennecott also is faced with the problem of relocating the old town of Ray, division shops, and possibly the near-by town of Sonora.

Originally an underground operation, the Ray mine went to open pit in 1948

Arizona *(Continued)*

Kennecott completes its own smelter out-

Arizona and 153,600 in southern Utah

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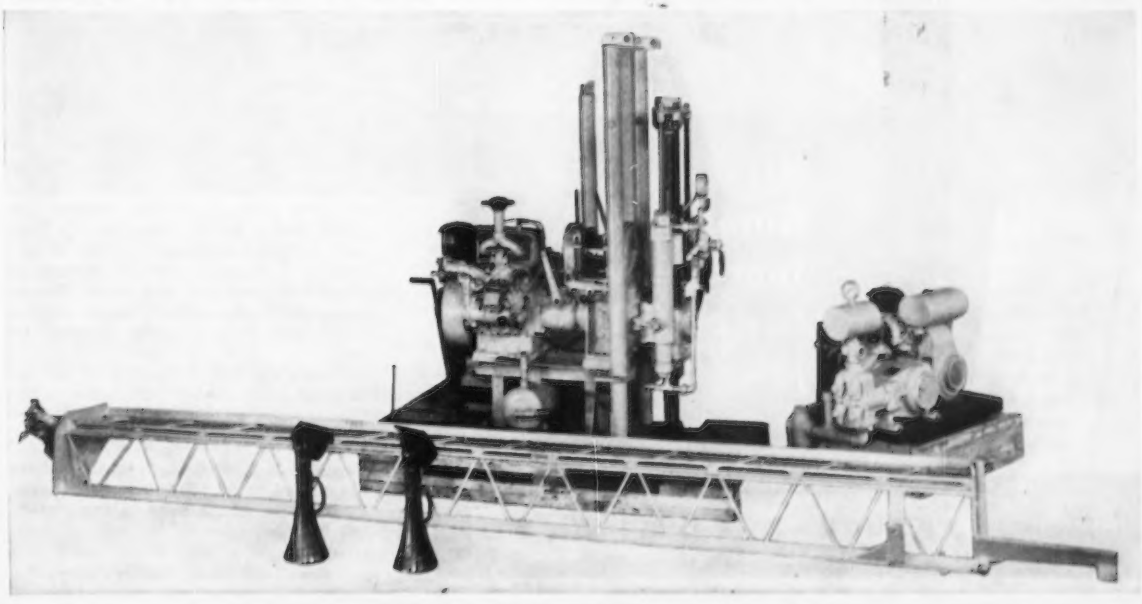
WRITE FOR BULLETIN 24-JG

Longyear Jeep-mounted "24" diamond core drill

The Longyear Mobile kit



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Arizona *(Continued)*

and the conversion was completed last year. With the Pearl Handle pit expanding into the two others—they eventually will form one pit—Ray now is producing 15,000 to 16,000 tpd ore that averages slightly less than 1% copper or 20 lb to the ton. The mine operates three shifts on a 7-day basis.

During the first four years of open pit operation, 43-million tons of worthless overburden was removed. Even today more than two tons of waste must be moved for every ton of copper ore.

A custom smelter presently handles Ray production on a toll basis. When Kennecott completes its own smelter outside near-by Hayden, the firm will handle its own output from the time it is mined until the concentrate is smelted into 400-lb cakes of blister copper.

Mining industry employ hit a 13-year high in Arizona in April with 14,900 on payrolls. This was an increase of 100 over March and 1,200 for the same date 1955. Copper mining leads with 12,700 employed.

The salary scale topped all averages for the state, with miners drawing an average of $112.79 a week.

Bureau of Reclamation has asked that 25,500 acres of public land in northern Arizona and 153,600 in southern Utah be set aside as a source of materials and campsite for construction of Glen Canyon Dam across the Colorado River. The request would withdraw the land from mining location.

Arizona's Department of Mineral Resources has released a report on wage statistics and copper output of Arizona mines. It shows that Arizona's copper miners had an average annual wage of $5,750 in 1955—an increase of 64.47% over the annual wage received in the base period 1947-49. Fringe benefits—which were not included in the wage figure—are estimated at more than 18% of the copper mining and smelting payroll which topped $94-million in 1955.

The tons per man hour produced in mining, smelting and milling increased 18.68% from 1.221 tons to 1.449. Pounds of copper increased 6.30% from 23.98 per man hour to 25.49.

Arizona College of Mines report made under contract with the Bureau of Indian Affairs, has been released surveying the Navajo-Hopi Indian reservations in Arizona and Utah. The two-volume report covers uranium, ground water, evaluation and recommendations for further exploration of operating mines and known mineral resources, an inventory of mineral resources of present and future value, and a study of construction materials. Project was conducted under the direction of George A. Kiersch, director of Indian Survey-Geological Project, University of Arizona, Tucson.

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CALIFORNIA

An extensive core drilling program is under way on a group of 61 uranium claims in the Coyote Creek area 7 miles west of Ojai, Ventura County.

Louis B. Mayer and Clarence Brown, Hollywood film notables, leased claims from Max Hoff, John L. Payer, Hubert L. Ofer, Joseph T. Ofer, John Kirkes and Raymond A. Charles, Oxnard.

Dean Nicholson, mining engineer from Grand Junction Colo., is directing the exploration program. Southern Geophysical Co., Bakersfield, has already drilled an estimated 1,000 ft of hole. Occurrences in the contact between the Sespe formation of Oligocene age and the Coldwater formation of Eocene age, have been likened to tertiary deposits in Wyoming and the Colorado Plateau areas. According to Hoff, some samples have showed a uranium content of 6.37%.

Leases are for 40 years and pay an average 10% royalty on gross sales Claims were located about a year ago through aerial reconnaissance.

Transfer of Kern County borax properties valued at $3,740,000 to the Pacific Coast Borax Co., a Nevada corporation, has been recorded in the Kern County recorder's office.

Involved in the transfer were the Borax, Ltd., parent corporation founded in England more than 60 years ago, and Borax Consolidated, Ltd., which deeded

Milo A. Burdick, plant superintendent,
Southwest Onyx & Marble Co.,
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"Union's UNOBA Grease solved the lubrication problems in our marble and onyx plant 10 years ago.

"Since we placed this remarkable grease on trial in 1946 we have practically eliminated bearing failures despite severe conditions of running water, abrasive grinding mixtures, and in many cases, extreme heat. Take the large crankpin bearings on our marble gang saws like the one shown here . . . they used to have an approximate life of six months. Now with UNOBA Grease to protect these bearings *they last indefinitely.*

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Yuba taper-drills screen holes to prevent clogging (unless you request straight sides). Holes can be as small as 3/16″ diameter; closely spaced for screening monazite sands and other rare earths. Thicknesses from 3/16″; length, diameter and other dimensions to suit your needs. Yuba screen plates are rolled true and cut square to close limits – insuring proper fit and fast installation.

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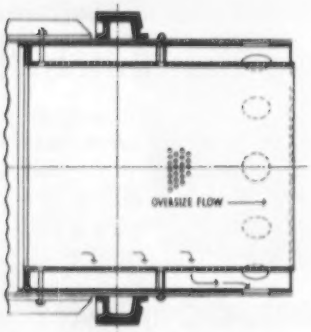

Yuba-built Olsen trommel increases screen capacity as much as 25%, by converting lower end blank shell plates into screening area . . . does not increase screen length.

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California *(Continued)*

39 parcels to Consolidated Borax, Inc., a Delaware corporation, for transfer to Pacific Coast Borax Co.

Parcels varied in size from a 15-ft strip to several sections. All are located near Boron in the Mojave desert in Township 11 North, Ranges 7, 8 and 9 West.

Court decision paved the way for resumption of uranium mining at the Miracle Mine in Kern Canyon, 35 miles northeast of Bakersfield.

Superior Judge Gordon Howden ruled Miracle Springs Mining Corp. is legal owner of 22 claims on which the mine is located. Claims were located in 1954 and later sold to M. W. Ditto, New York, who later formed the corporation.

Ownership dispute arose after it was ascertained the mine was on power withdrawal land and the land subsequently was thrown open for mining operations.

In July 1954, the first carload shipment of uranium ore from California was made from the Miracle Mine.

Coso Uranium, Inc., is exploring every possibility which might provide milling facilities in the immediate vicinity of its property, according to W. O. Merritt, president.

The company has 520 acres of claims in the Coso Range, 10 miles east of Olancha, Inyo County. Company has shipped 400 tons of ore since last December.

Claims are located some 90 miles north of Verdi Development Co.'s idle mill near Mojave, Kern County.

China Lake Mining Co. is completing a core drilling program on 31 claims in the Coso Mountains, Inyo County. Average depth of the holes is 200 ft. Company geologist is R. E. Clute, Los Angeles.

Uranium prospecting is active in the Huntington Lake area, Fresno County, following identification of bog-type deposits recently.

The new-type deposits appear to be a natural for local milling facilities. Testing has indicated up-grading is possible through burning and washing.

C. Hyde Lewis, president of New Idria Mining & Chemical Co., announced June 18 that the company has acquired the Beaver Petroleum Corp. of Wilmington, Del., and the Laan-Tex Oil Corp. of Dallas, Tex. In exchange of 2,120,000 shares of its stock, New Idria has taken over all assets and properties of the two companies, subject only to a $3-million payment for oil lands which is to be met out of future oil production.

COLORADO

Operation of the U. S. Bureau of Mines' oil shale experiment station at Rifle, Colo., was assumed by the U. S. Navy, July 1.

Transfer to the Navy followed failure of Congress to supply funds for con-

. . . and the World Over

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In mines all over the world, Bucyrus-Eries in the key spots help assure economical operation, regardless of conditions. Investigate their design and construction and you'll see why. Smooth-acting Ward Leonard control means extra fast acceleration and deceleration to speed work cycles. Superior front-end design provides high strength without dead weight. Heavy-duty construction throughout assures long machine life and low maintenance costs.

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CARD car engineering results in large savings to many of the major ore producers of the world with cars built to special order at little more than the cost of standard stock models. CARD engineers are happy to consult on any haulage problem. No obligation.

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Colorado *(Continued)*

tinued operation by the Bureau of Mines. Boyd Guthrie, former director, is staying on under the Navy as consultant and superintendent.

Navy Cdr. Emory C. Smith, deputy director of naval petroleum and oil shale reserves, told an audience at Rifle, July 3, the Navy oil shale task force will launch a three-point program at the plant. The Navy, he said, will:

1. Maintain the plant and bring it to top condition.
2. Establish a definite program for development.
3. Continue the research program in an effort to obtain commercial products from oil shale at a price competitive with natural petroleum products.

Cdr. Smith said the Navy would have no appropriation difficulties such as faced by the Bureau of Mines in the past. "The forces opposing these activities should be hunted out in the interest of national defense," he said. America becomes more and more an oil importing nation, he said.

About 40 plant employees are remaining under the Navy operation.

Others have been transferred by the Bureau of Mines or have found other jobs.

Rex Uranium Corp reported it has blocked out 40,000 tons of high-grade ore on its Equinox claims near Uravan. Company reported shipments totaling 846 tons from its Adak mine in May.

Premiere showings of "The Petrified River —The Story of Uranium," were held in Denver and Grand Junction in June.

The documentary film, costing over $100,000 was made for Union Carbide and Carbon Corp. in co-operation with the U. S. Bureau of Mines. The film shows the origin of uranium, prospecting and mining techniques, milling and end use.

Atlas Uranium Corp. now is mining and stockpiling about 50 tpd at one of its lead-zinc-silver properties near Crested Buttes in Gunnison County, president J. C. Burgess says, and expected to begin milling about Aug 1. Assays indicate ore will average about $36 per ton.

Continental Uranium, Inc., announced in June it has acquired nine claims in San Miguel County, including a group of five which had been mined previously.

Utaco Uranium, Inc., expected to ship its first carload of concentrates from its mill at Ouray in July. The mill is processing lead-zinc ore from Utaco's Bradley mine near Telluride, and a 100 tpd output is anticipated. Main offices of Utaco, now at Moab, Utah, are to be moved soon to Denver.

Cotter Corp. of Santa Fe, N. M., plans to join International Minerals & Chemical Corp. in development and operation of a thorium property near Canon City. The two companies released a joint statement at Canon City that they have reached a preliminary agreement on the mining and processing of thorium ores at Parkdale.

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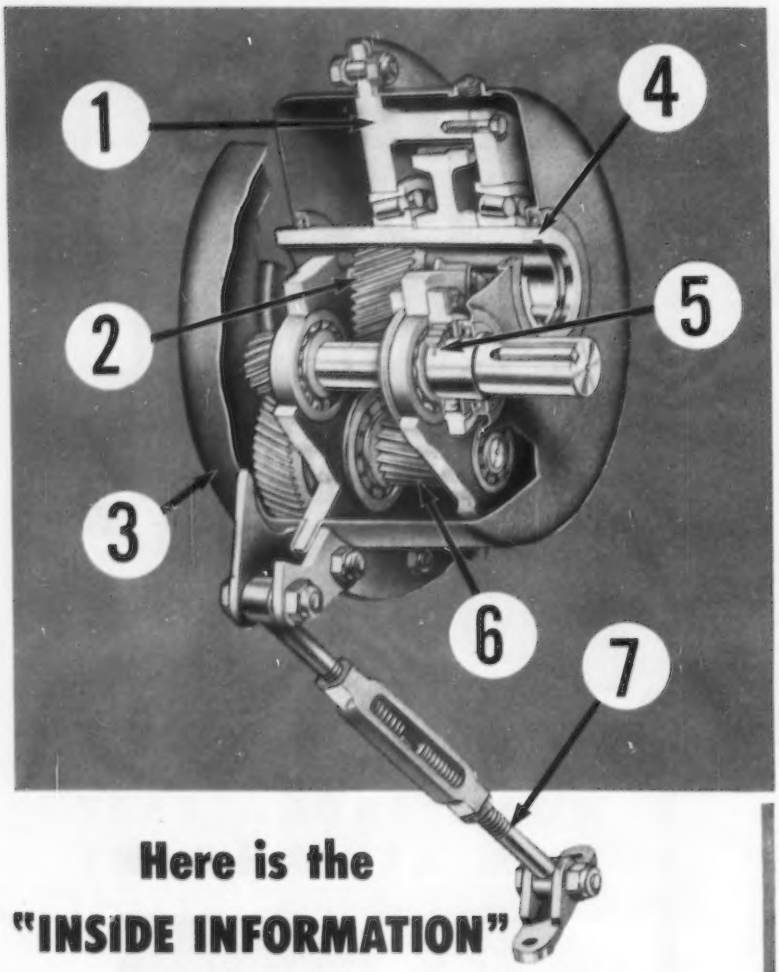

Here is the "INSIDE INFORMATION" on FALK ALL-STEEL Shaft Mounted Drives

Take a careful look inside the Falk all-steel Shaft Mounted Drive, and you will know why this newest member of the famous Falk family is ideal for applications where direct mounting on the driven shaft is desirable. It is the only drive in its field with all these superior "In-built" factors:—

1 **All-steel Frame,** with more than double the rigidity of iron, supports all rotating elements.

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3 **Pressed Steel Housings,** whose sole function is to keep oil in, dirt out; easily removed for gear inspection without dismounting unit.

4 **Through Hollow Shaft** with counter bore provides for easiest installation or removal from driven machine shaft extensions.

5 **Backstop** can be furnished with the unit or added later for positive prevention of reverse rotation.

6 **Positive Lubrication,** continuous direct dip of revolving elements at all speeds.

7 **Tie Rod** and turnbuckle serve as anchor and facilitate V-belt or chain adjustment.

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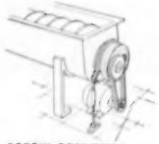
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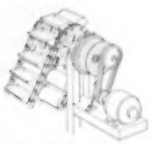
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Colorado *(Continued)*

International has a 1,000-ton flotation mill at Parkdale and is skilled in the beneficiation of ores. Cotter Corp. controls substantial acreage of thorium properties in the Wet Mountain area southwest of Parkdale and will acquire and develop the mining properties. Pilot plant work is being done by International prior to reactivation of the Parkdale plant.

John T. Riordan and G. L. Fairchild, Denver mining men, have contracted for purchase of some 2.5-million lb, vanadium from Kerr-McGee Oil Industries, Inc., Oklahoma City, Riordan announced. He also said they would take all of Kerr-McGee's vanadium production from its Shiprock, N. M., mill for the next 18 months. He said most of it already had been sold to Associated Metals & Minerals Corp., New York, which expects to sell it abroad in Germany, Switzerland, Japan and elsewhere. Riordan is president of Gibraltar Uranium Corp. of Denver, and formerly was president of Sylvania Mining & Milling Corp.

The famous Vindicator mine of United Gold Mines Co. at Cripple Creek is in the process of being brought back to the status of one of the district's big gold producers. At the present time workmen are doing cleanup work on the bottom levels that have been drained by a lateral run from the Ajax shaft.

Shipments of high-grade uranium ore from the Schwartzwalder Mine, which is owned and operated by the Denver-Golden Oil and Uranium Co. and its associates, have exceeded 1,000 tons for the month of June.

Denver-Golden has mined and shipped a total of approximately 2700 tons from this property through year end and is beginning another tunnel with a view to expanding production to 2,000 tpm.

The shaft on the company's Ladwig property is nearing completion and drifting under the orebody with resultant resumption of mining began in July.

Gold ore running at the mill from $16 to $35 per ton is being shipped daily from the Deadwood mine at Cripple Creek reports Lloyd Stoner, superintendent of the mine. The ore is on the 300-ft level of the mine and at present time is being mined from a stope nearly 80 ft high and 3 ft wide. Samples from the stope have run anywhere from 2 to 32 oz gold per ton. John King and Norman Berry are doing the mining. Also in the 300 level of the mine, Leslie and Harold Barnett resumed leasing operations on June 1. Before they gain access to their ore, a 100-ft drift is to be driven.

Gold bricks No.'s 300 and 301 were poured at Cripple Creek's Carlton Mill recently for a total worth of $71,600. The two bricks were taken to the mint in Denver by armored car. May was one of the biggest months for the mill with 11,940 tons of ore purchased. Bulk of this ore was shipped by Cresson, which is at present pulling a large stope on the 2200 level.

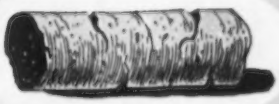
IDAHO

Anaconda Co. has started shipments of alumina-rich clays from optional properties in the Troy-Deary area of Latah County to the pilot plant at Anaconda, Mont., where efforts are being made to develop a process for economic recovery of the aluminum trioxide content. Plans are to accumulate about 20,000 tons of the material at the plant this summer for experimental purposes. Anaconda has been investigating the Latah County clay resources for more than a year in the hope that a means can be found for utilizing this domestic material at its aluminum reduction plant at Columbia Falls, Mont., in place of the foreign bauxite now being used.

Another company to join in the clay investigations in the area is the J. R. Simplot Co. of Boise, which has acquired a mineral lease on 900 acres near Bovill. Drill tests to determine the clay content are now in progress and samples are being sent to the Bureau of Mines laboratory at Albany, Ore., for tests to determine whether it is suitable for use in ceramic power insulators and as a filler in enamel paper.

If present experiments prove successful, Anaconda plans to build a $10-million up-grading plant which will employ about 400 people at Moscow, and the Simplot firm will build at Bovill.

MORE CORE



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ADJUSTABLE INNER TUBE: To regulate the force of the fluid at the mouth of the bit and to reduce the interval in which the core is subject to wash by the circulating fluid.

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STABILIZED INNER TUBE: No core lost because of friction grinding.

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SIZES: AX . . . BX . . . NX.

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Remove 4 Bolts and there's the impeller! . . . no need to disconnect piping

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TYPE RX
Slurry Pump

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Morris Type RX is the slurry pump whose impeller can be removed without disturbing the suction and discharge piping or the bearings! To get at the impeller and renewable shaft sleeve, you simply loosen four outside clamping bolts—slip them out of disc slots—take off the end cover. Impeller unscrews from shaft threads; shaft sleeve is removed through end cover opening.

At no point do you have to dismantle the piping. Lay-up time costs are less . . . pump is back in service quicker.

Use the Morris Type RX in Your Mining Operations

Morris Type RX is the product of nearly a century of experience in designing and building materials-handling pumps. It is specifically engineered to handle mixtures containing ore concentrates . . . tailings, slag and residue from filters and classifiers . . . all types of caustic or acid mixtures containing abrasives or solids.

MORRIS CENTRIFUGAL PUMPS

MORRIS MACHINE WORKS
Baldwinsville, N. Y.
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Idaho *(Continued)*

Bradley Mining Co. will reactivate its big antimony smelter at Stibnite this summer to process and refine Sunshine Mining Co.'s 2,000-ton stockpile of cathode antimony metal, according to John D. Bradley, executive vice president. He said test runs have shown that the plant can satisfactorily remove the arsenic content of approximately 3½% from the metal which Sunshine produces as a by-product of the silver-copper concentrating process which it employs at its big silver mine between Kellogg and Wallace. Bradley estimated it would take from six to seven months to process the stockpile.

Mine production in the Coeur d'Alene District declined for the fourth consecutive year in 1955 to 1,406,443 tons with a gross value of $38,436,531. A labor strike which kept a number of producers shut down during the final four months of the year was responsible for the drop. Twenty-six mines and 12 leasing operations were included in the 1955 list of reports to the Shoshone County assessor. In the previous year 27 mines and 15 leasers reported a total output of 1,496,325 tons worth $39,407,918. This was also far below the recent peak year of 1951 when 1,960,892 tons of ore valued at $59,663,980 were extracted.

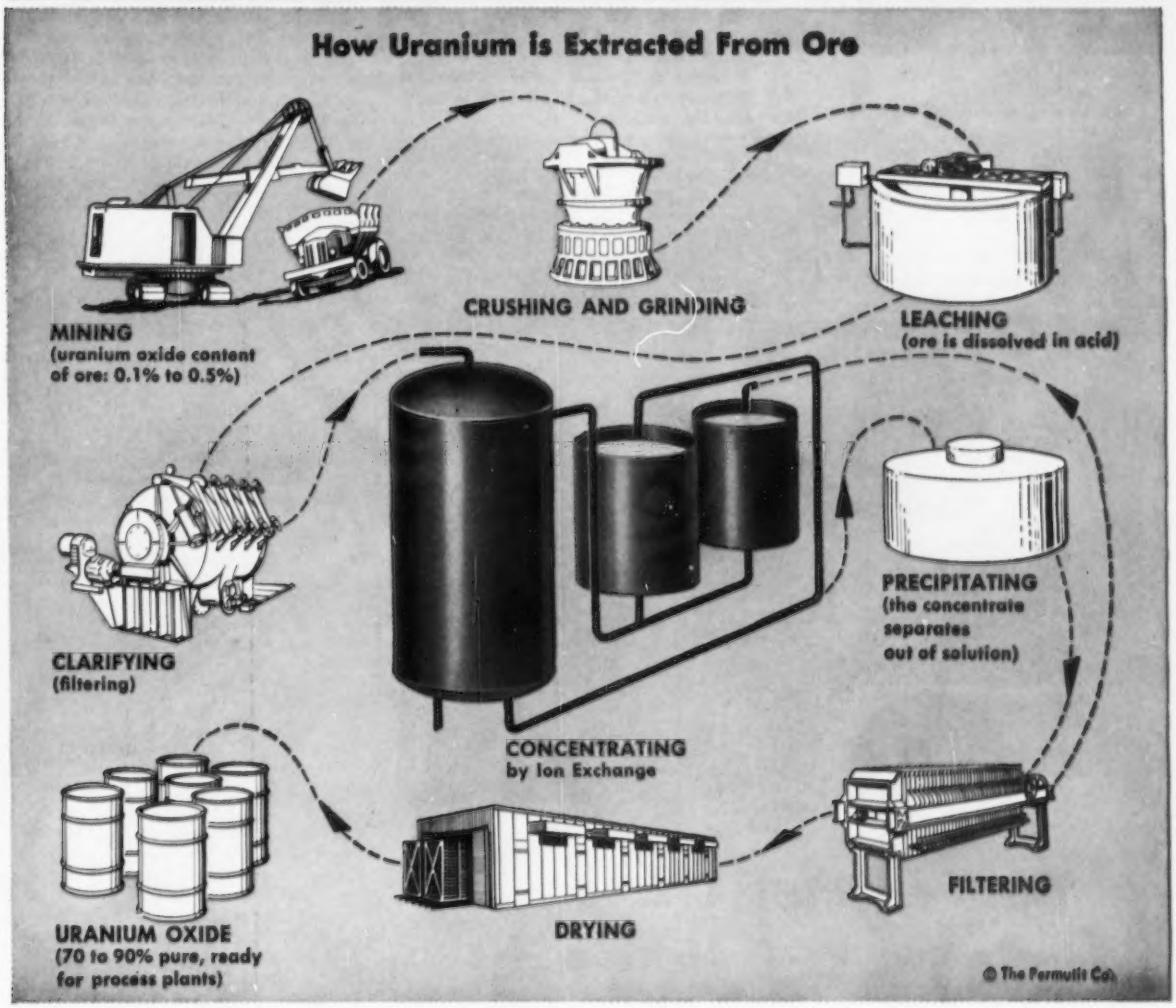
The big Bunker Hill Mine at Kellogg accounted for more than one-third of the district's output last year, with a 30% increase in output to 539,515 tons. The value of ore produced was up more than 20% to $14,872,858. Second largest producer was the Star Mine at Burke, owned by Bunker Hill and operated by Hecla Mining Co. Its 1955 output totaled 207,781 tons with a gross value of $6,530,636.

American Smelting and Refining Co.'s four mines in the district—the Page, Morning, Frisco and Vulcan-Galena—yielded a combined total of 227,622 tons worth $6,093,413 last year, while total production by Sunshine Mining Co., including ore from adjoining properties operated under profit-sharing agreements, was 225,883 tons, which was valued at $6,206,252.

General Uranium Inc., headed by J. L. Simpson of Coeur d'Alene, has reported a new discovery of uranium ore on its 10-claim property in the Lamb Creek field of northeastern Washington, near the Idaho border. Two bulldozer cuts have exposed mineralization of commercial quality, officials said. Company also has a preliminary diamond drilling program in progress on its Shrauner-Taylor lease south of Kit Carson Mt. in northern Spokane County, Wash.

Goldstone Mining Co. has let a contract to T. D. French of Wallace for a diamond drilling program at its Lemhi County gold property near Salmon. One 500-ft horizontal hole will be drilled from the face of the 2,150-ft main haulage tunnel to test the extent of the ore zone on the 1,000 level, and another will be angled upward at about 30 deg to probe the 800 level horizon. If holes are sufficiently encouraging, additional down-holes will be put in.

PROCESSES: Ion exchange "swaps" chemicals in solution at high speed . . . purifies, recovers, concentrates, separates. An example:



Ion Exchange Cuts Uranium Costs

One reason uranium is costly is because it's spread so thin. Even a ton of good ore contains only 10 lb. of uranium oxide. And when that ton of ore is dissolved, its 10 lb. of uranium is hidden in 5 *tons* of leach solution!

• **Solutions that dilute** would be almost too expensive to handle if it weren't for the ability of ion exchange to pick out "the needle in the haystack." Take the above example . . . ion exchange-precipitation takes the 10 lb. of uranium out of the 10,000 lb. of leach solution in one simple step . . . then delivers it in as little as 12 lb. of concentrate! It also discards other elements that generally stick close to uranium . . . eliminating special up-grading steps. The results: *more* uranium per ton of ore and at a lower cost than by former methods . . . and *higher grade* uranium that cuts subsequent refining costs.

• **That's why Permutit** ion exchange is at work at African, Canadian and U. S. uranium mines.

• **This compact process** also concentrates metals from industrial wastes. For example, it recovers valuable chromium from exhausted plating baths and rinse waters and, at the same time, eliminates a tough and costly waste disposal problem. It recovers copper and zinc from rayon wastes. It also removes unwanted minerals and other impurities from process and boiler feed water, chemicals, sugar solutions and hundreds of other products.

• **We'll be glad** to look into ways it might apply to your process. Write to The Permutit Company, Dept. EMJ-8, 330 W. 42nd St., New York 36, N. Y.

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Idaho *(Continued)*

Stockholders of Pathfinder Uranium Inc. of Salt Lake City, have approved a proposed merger into Northwest Uranium Mines Inc. of Wallace and similar action is under consideration by Eastern Lead Corp. and Fortune Mining Co., both Wallace firms.

Northwest Uranium has been the operating company for the three firms, and also for Silver Buckle Mining Co. of Wallace and Stansbury & Associates of Spokane, on their joint uranium explorations in northeastern Washington and in Arizona and New Mexico.

Greatest exploration success to date has been achieved on the Spokane Indian reservation in southern Stevens County, Wash., where preliminary drilling has disclosed extensive commercial deposits. Three drill holes into one bedded deposit indicate a minimum of 60,000 to 70,000 tons of ore worth upwards of $1-million, with the limits of the ore zone in three directions still undisclosed.

A 200- to 300-hole drilling program is currently in progress in an effort to delineate the orebodies.

Directors of the Bunker Hill Co. have authorized addition of a sixth and final unit at its electrolytic zinc plant near Kellogg for a full 50% expansion from 4,800 tons per year to 7,200 tons. Plans for the expansion program were announced some months ago, but at the time only one additional 1,200-ton unit was authorized. The project has been underway since early this year. Total cost of the two-unit addition is estimated at more than $7-million.

In pursuance of a recently-adopted policy to divest itself of all activities not directly concerned with mining and metal refining, the company has agreed to sell its Lighthouse electric distribution system in Kellogg to Washington Water Power Co., subject to approval by the Idaho Public Utilities Commission, and has started to dispose of company-owned housing facilities for employees originally constructed by Bunker Hill.

Exploration activities are being stepped up to find new sources of lead and zinc with which to keep the company's smelting and refining "pipe-lines" filled, and a purchase option has been acquired on the properties of Bayhorse Mines Inc., including the old Ramshorn group, in the Bayhorse District of Custer County south of Challis.

Idaho Custer Silver-Lead Mines Inc., a new assessable Idaho corporation, has taken over all the assets and liabilities of Idaho Custer Mines Inc. and expects to continue the development program at the Livingston Mine in the Boulder District of Custer County with funds obtained from assessments on the stockholders. Funds from the initial current levy will be used to match a balance remaining due on a DMEA project approved for the property, which includes 450 ft of shaft work and lateral exploration at the new depth attained. The sale to the new assessable company was approved by about 80% of the outstanding Idaho Custer Mines stock.

Leasing operations at the Sunset Mines' property in the Pine Creek area of the Coeur d'Alene District have put the company on a profitable basis for the first time in three years, officials reported recently. Mining operations were put on a lease basis following the settlement of a labor strike last Feb. 1, and company activities are confined to milling lessee's ore, conducting exploration work on the main adit level, and carrying out a tunnel-driving contract into adjoining Lookout Mountain Mining & Milling Co. property from the 1,200-ft shaft level of the Sunset Mines workings.

A northerly diamond drill hole from the East Exploration lateral which Polaris Mining Co. has driven more than 9,000 ft east from the 3,000-ft level of the Silver Summit shaft has penetrated favorable ore indications about 500 ft north of the lateral in Rainbow Mining & Milling Co. property. Drill hole, about 250 ft back from the face of the tunnel, cut through two 5-ft veins about 10 ft apart, one of which assayed 20 oz silver per ton and the other about 12 oz. Another drill test from the tunnel face 250 ft to the east had failed to encounter the structures at last report. Project is a DMEA undertaking involving profit-sharing agreements between Polaris and the owners of properties east of the Silver Summit Mine.

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Holes need not be blown before loading and rods can be pulled easily when you follow this proven blast hole drilling technique—drill (1) small holes—(2) use airlegs—(3) with non-rifling Brunner & Lay carbide Rok-Bits® on Brunner & Lay drill rods.

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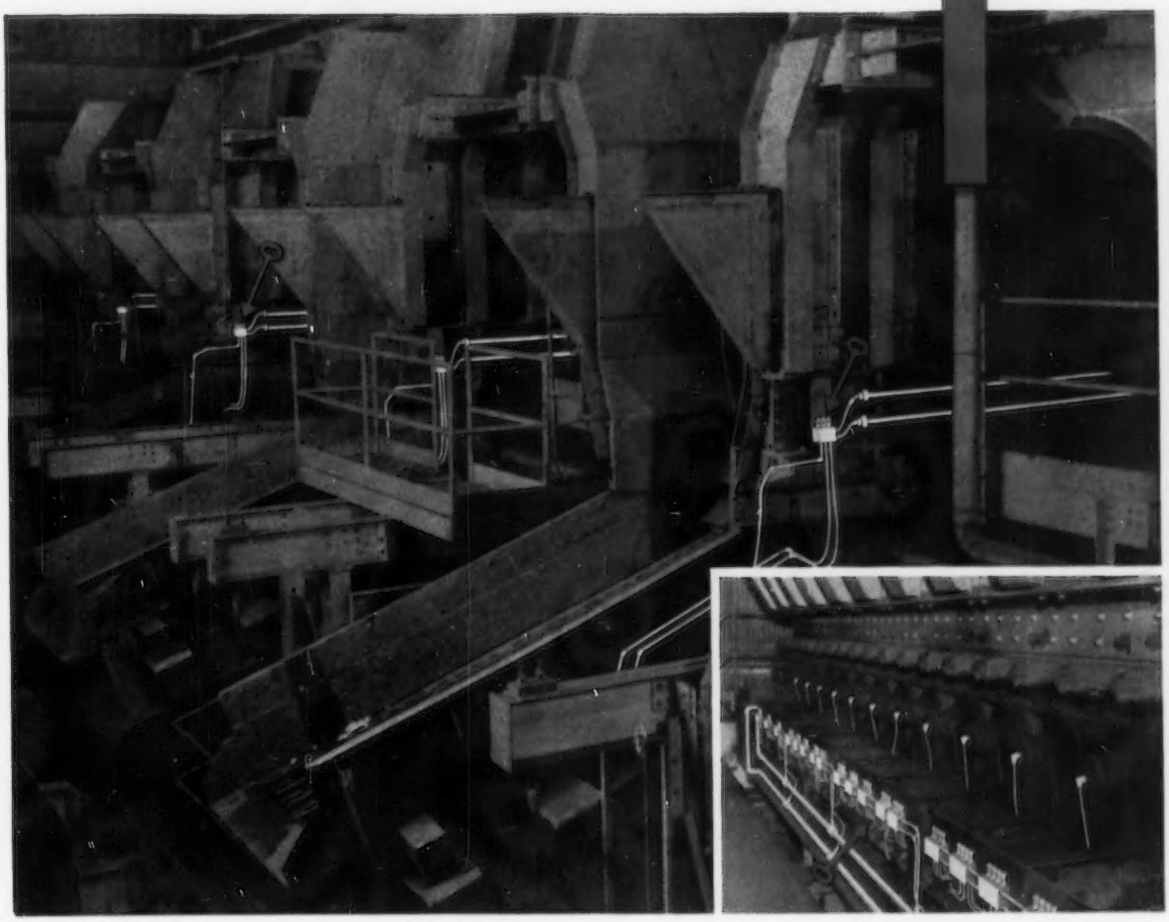
No. 193



KEYS TO ADEQUATE LUBRICATION—
Wherever you can see these Farval manifolds, dual lubricant lines and central pumping station, you know a machine is being properly lubricated.

Above—four pan feeders and their screens at the Sherman Crushing Plant. Below—close-up of Farval valves serving a feeder.

CRUSHING and handling iron ore creates extreme pressures on processing equipment; so proper lubrication is vital to prevent overheated, ruined bearings, with consequent work stoppage, lost production and needless maintenance expense.

To ensure dependable, adequate lubrication of their equipment, Oliver Iron Mining's Sherman Crushing Plant at Hibbing, Minnesota, installed Farval Centralized Lubrication. A total of 2,000 bearings on crushers, pan feeders and screens are served from two Farval automatic pumping stations.

By protecting equipment, Farval saves labor—helps to maintain production schedules. With Farval on the job, oilers are kept out of the dangerous machine areas—a safety factor. Lubricant lines reach bearings even in the most inaccessible places to apply oil or grease in measured quantities as frequently as desired.

Farval can serve any machinery builder or owner—efficiently, economically, permanently. For details, write for Bulletin 26-R. The Farval Corporation, 3281 East 80th Street, Cleveland 4, Ohio.

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MICHIGAN

A total of 899 tons of iron ore which was shipped from Menominee range mines in 1955 did not reach the ore docks because of train wrecks between mines and docks. The Marquette range lost 260 tons in this way; the Gogebic, 400 tons.

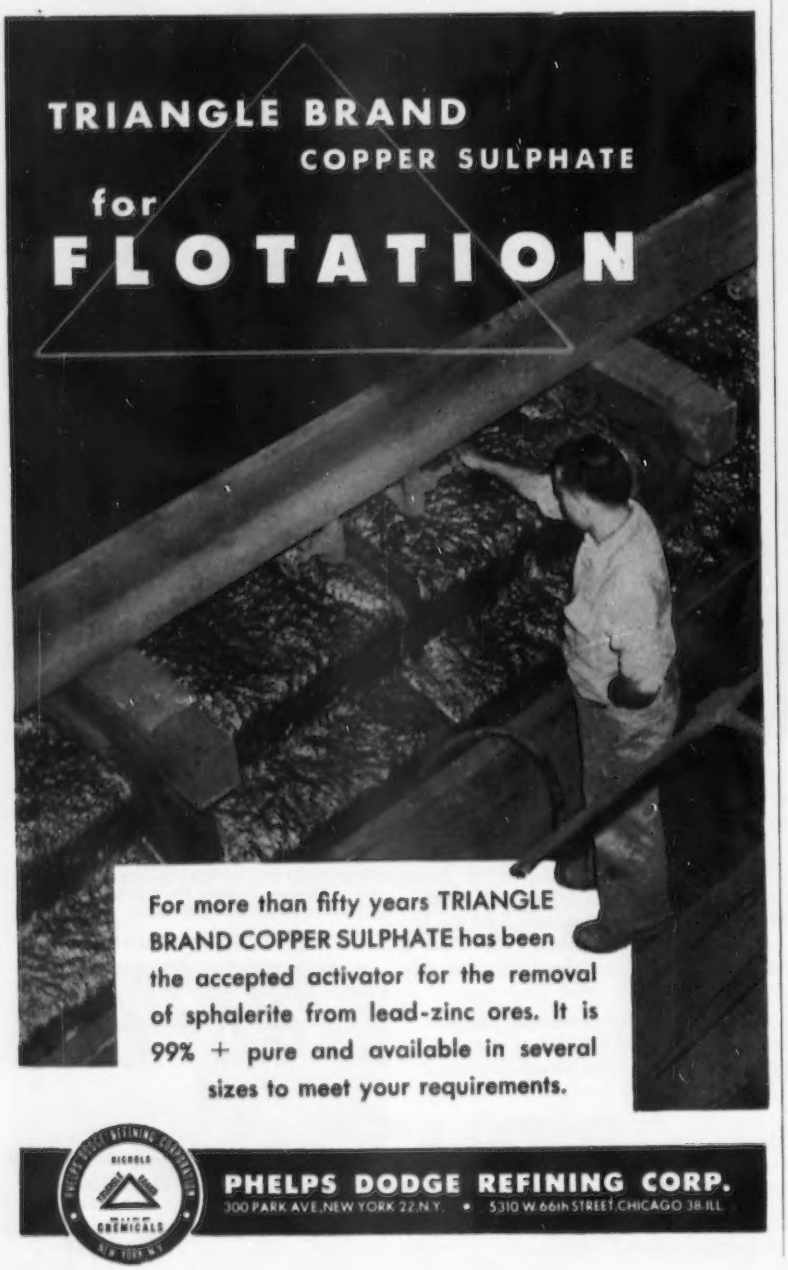
Wakefield open pit mine at Wakefield, where stripping was begun last fall by the E. W. Coons Co. of Hibbing at the east end of the pit, is again shipping ore. Mine was formerly operated by the M. A. Hanna Co. and the last shipment was made from stock-pile—152,287 tons—in 1954. The pit is now being operated by the Pittsburgh Pacific Co. of Hibbing.

Rail shipments from Iron County mines in 1955 included 67,689 tons from the Buck group; 301 tons from the Fortune Lake open pit; 329 tons from the Monongahela, all Pickands, Mather properties; and 12,666 from the M. A. Hanna Co. Wauseca mine.

Michigan's three iron ore ranges: the Marquette, Menominee and Gogebic, shipped 17.83% of the total Lake Superior iron ore forwarded in 1955.

In mid June, North Range Mining Co. stepped up its operations at the Book mine at Alpha from 5- to 6-day week. The mine's concentration plant remains on a 5-day week. Plant operates on a 3-shift basis and the mine does not produce enough ore on a 5-day week to keep the plant's heavy media unit going. North Range's Warner mine at Amasa continues as a 5-day operation.

Homer mine of the M. A. Hanna Co. has completed modernization of its underground pumping plant by replacing the old piston type manually controlled pumps with automatic controlled centrifugal pumps. Other Hanna Co. mines in the Michigan district have also been converted to automatic centrifugal pumping. Homer pumps handle 2000 gpm and 100% standby capacity is provided. Because the water is strongly sulphurous, ordinary steel pipe will last from 3 to 6 weeks and bronze pump impellers from 1 to 3 weeks. Therefore all piping is rubber lined and pumps are of stainless steel.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MINNESOTA

Lake Superior Association reported that Great Lakes iron ore carriers moved 3,205,802 tons of ore during the week that ended on June 18, bringing the season total as of that date to 25,867,540 tons, which was 3,344,299 tons more than the corresponding date in 1955. This was the first week of the 1956 season when shipments passed the 3-million ton mark.

On June 13 the state of Minnesota collected $31,501,135.84 in iron ore occupation taxes of which Oliver Iron Mining Division's share was $19,370,985.71. Other companies whose tax was well over $1-million were: Hanna Ore Mining Co.; Jones & Laughlin Steel Corp. and Mahoning Ore & Steel Co. Last year's total occupation tax was $16,587,914.95. Taconite taxes paid on the same date were $77,859.61—more than $25,000 higher than last year's. This figure will increase rapidly during the coming years.

Oliver Iron Mining Division's Pilotac taconite plant at Mountain Iron, and its other observation stands along the range from Eveleth to Taconite, were opened to the public on June 26th. In making the announcement of the opening date, president R. T. Elstad said the Pilotac plant "will be open through Labor Day to permit tourists and vacation visitors, as well as Minnesotans, to visit our mining operations and learn something about one of the state's largest industries." He said that nearly 200,000 people visited the mine observation stands last year and more than 20,000 visitors have toured the Pilotac plant since it was first opened to the public in 1954.

Tours will be conducted daily, except on Wednesdays, and will start on the hour from 9 A.M. to 4 P.M. "The Pilotac plant is the only such plant in Minne-

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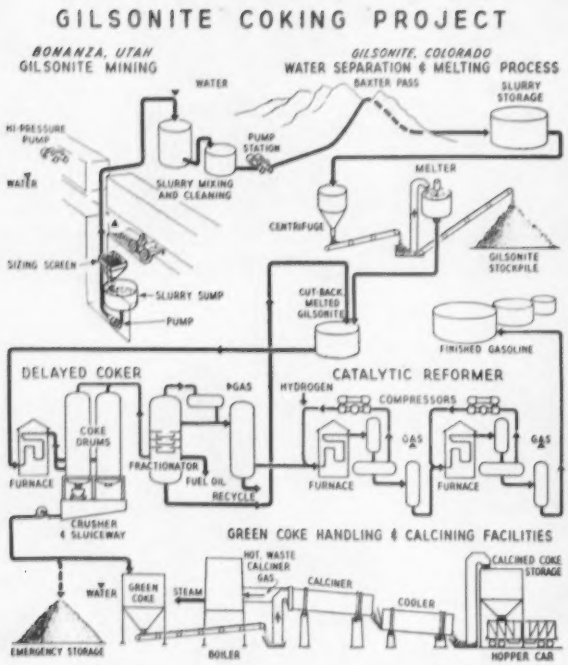
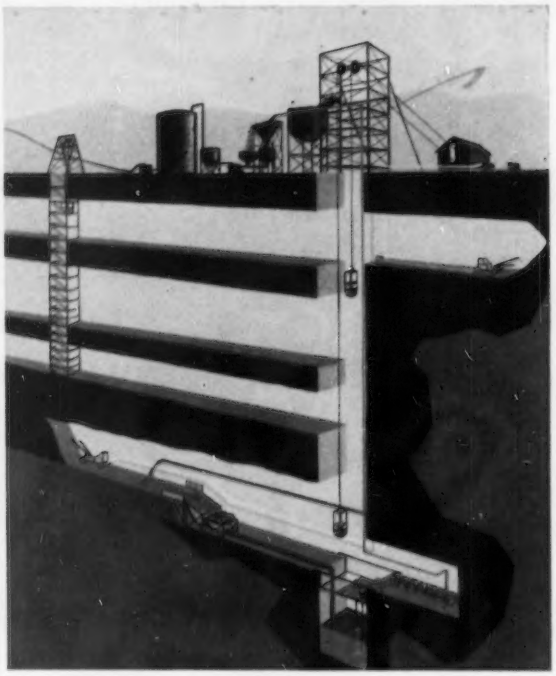


ORE is mined in Utah, piped to Colorado and processed. Product yield is 1300 bbl per day gasoline, 300 bbl fuel-oil.



HYDRAULIC METHODS involve washing ore down slightly-sloped drifts to sump. Buckets hoist mixture to surface.

American Gilsonite Pipes Slurry 71 Miles to Coke Processor

PRODUCTION OF PETROLEUM PRODUCTS from a solid hydrocarbon in Green River-White River area of the Colorado-Utah border will involve a massive hydraulic mining venture in the Uintah Basin of Utah, a 600-tpd refining plant near Grand Junction Colo., and a 71-mile pipeline to convey slurry from the mines to the catalytic gasoline and coking plant.

The $16-million project is being directed by American Gilsonite Co., co-owned by Standard Oil Co. of California and Barber Oil Co. (For full description of the project, see *E&MJ*, August 1955, p 120.)

Hydraulic process was initiated by the company for efficiency of mining—most of the ore is fissured and easily broken up by the 2,000 psi pressure from jumbo-mounted nozzles—and for greater safety. Dust from more orthodox mining methods presents an extremely dangerous hazard.

Ore is washed to a sump at the foot of the main shaft in each of the two mines at Bonanza, Utah, and then hoisted in buckets to the surface where it is cleaned and mixed with water for pumping over the Baxter Pass (elevation 8,492 ft). Suspension bridges support the pipe over two major passes, and powerful pumps keep it moving. A reservoir at the peak provides emergency storage if the pipeline becomes stopped.

Design of the pipeline was also studied at the Colorado School of Mines Research Station, Golden.

Michigan *(Continued)*

sota where tourists can stop and actually see how taconite is processed."

W. S. Moore Co., Duluth, has optioned a tract of land owned by the Newton Falls Paper Co. near Star Lake, N Y. and Jones & Laughlin Steel Corp's Benson Mines. A drilling exploration program will be begun soon.

MONTANA

Full production of the iron mines in the Little Belt mountains is expected by midsummer.

Such is the belief of Dewey F. and Norman A. Whittaker, principal owners of the iron mine claims. Dewey owns most of the Willow Creek property, while Norman has the Sage Creek claims. Both are about 15 miles south of Stanford and are in the Lewis and Clark National Forest.

The mines will be developed by the Young-Montana Corp. E. A. Young, Hibbing, Minn., is president of the corporation.

An estimated 50-million to 200-million tons of iron ore are in these deposits, the Whittakers report. They say these estimates were made on the basis of diamond drill tests by a group of engineers, including Norman E. Stines, Seattle, Wash.; Chester T. Keenan, Pueblo, Col.; and Dwight E. Woodbridge, Duluth, Minn.

The area planned for operation extends from one end of the deposit to the other, covering a distance of eight miles. It includes numerous open cuts, shafts, and tunnels.

One tunnel, Norman Whittaker said, is approximately 600 ft into the mountain. Iron is tapped at a depth of 200 ft. The orebody is 37 ft wide at that depth, Whittaker stated. He added that more than 50% of the cuts revealed ore.

There will be no ore mined in the Little Belt production containing less than 60% iron. The bulk of the ore will have an average content of 67% with some as high as 69%.

The annual goal for the operation will be in excess of 100,000 tons, Whittaker said.

The initial operation will be on the Willow Creek claims. It will be an open pit mine, as will the second project on Sage Creek. All subsequent operations will be underground, he said.

NEVADA

Cinnabar is being produced at the White Caps mine property in Lander County while work is being done on the shaft and underground operations preparatory to production of gold and silver values. A recent assay of the mercury ore showed

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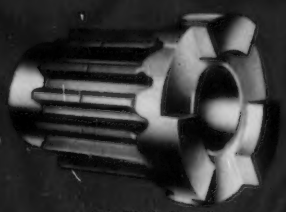

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Enjoy the tremendous savings in operating and maintenance costs you receive from guaranteed "Tool Steel Process" products.

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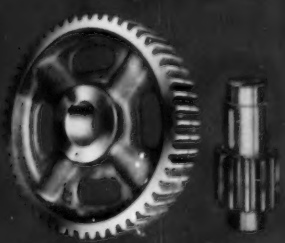
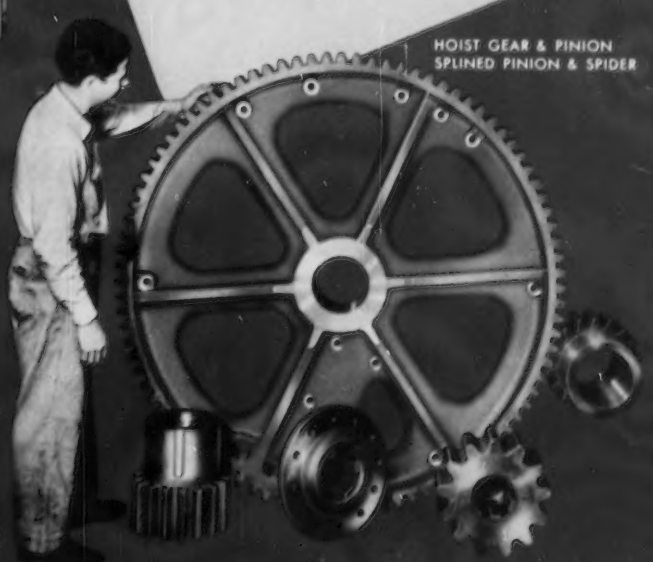


SPUR GEARS & SHAFT PINIONS

ROTATING SHAFTS

SHIPPER SHAFTS & PINIONS



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THE Carbon Fuel Company operates 40 units in its coal mining work in Kanawha County, West Virginia. Trucks haul slate, slag and other coal refuse, with loads often reaching 29 tons, over rugged mining roads. Tires take a terrific beating on a job like this.

But Carbon Fuel uses B. F. Goodrich Universal and Rock Logger tires, reports as much as 4,438 hours of service from them! Says Purchasing Agent W. M. Brackenridge, "They give us better traction and less down time."

B. F. Goodrich Universal and Rock Logger tires are specially compounded to resist rock cuts and bruises. The extra-thick tread has husky cleats that dig in and pull. And under the tread you can get the B. F. Goodrich *all-nylon* cord body. It withstands double the impact of ordinary cord materials, resists heat blowouts and flex breaks. No wonder the B. F. Goodrich *all-nylon* body outwears the tread, *can be recapped over and over!*

Why not follow the lead of mine operators all over the country and switch to B. F. Goodrich tires. See your nearby B. F. Goodrich retailer today or write *The B. F. Goodrich Co., Tire & Equipment Div., Akron 18, Ohio.*

TONS OF SLAG pour onto this truck equipped with B. F. Goodrich Rock Logger tires at Carbon Fuel Co. mine near Carbon, W. Va.

"WE PREFER the Universal tread over any other," says Roy J. Ault, Superintendent of Shasta Coal Corporation, Bicknell, Indiana.

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HOUSE ROLLS are automatically built up with 2 or 3 passes of Stoody 104.

How one of the country's large contracting firms MAINTAINS SHOVEL PARTS

The shovel parts illustrated here are typical of those regularly rebuilt and hard-faced by George M. Brewster and Son, Inc., famous for the big jobs handled, such as the New Jersey Turnpike and approaches to the George Washington Bridge. Standard maintenance practice includes complete restoration of worn house rolls, buckets, bucket teeth, pads and tumblers.

After rebuilding, the Stoody 104 deposit is machined to original size. This is one of the few parts requiring machine work. Others go into service "as-welded."

In the Brewster operation Stoody Hard-Facing Alloys are used for both manual and automatic applications. They help to keep equipment in service longer between repair periods and reduce the number of replacement parts that must be stocked. Life of rebuilt parts is invariably equal to or greater than the original equipment—yet the cost of rebuilding and hard-facing is but a fraction of new part costs.

Procedures followed here and by other major earth-moving contractors are described in detail in the Stoody Hard-Facing Guidebook and other Stoody literature; consult your Stoody dealer (see the "Yellow Pages" of your phone book) or write direct for full information.

WORN SHOVEL PADS. Conventional treatment includes rebuilding worn areas with Stoody Manganese and manually hard-facing with Stoody 1027.

OTHER SHOVEL HARD-FACING APPLICATIONS

Besides the applications shown, Stoody Hard-Facing Alloys are regularly used all over the nation for rebuilding and protecting Shovel Idlers, Drive Tumblers, Boom Heels, Latch Bars, Latch Plates, Buckets and Bucket Teeth. Wherever there's wear, you'll find effective prevention with STOODY ALLOYS!

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BREAKDOWNS ON ANY MINING JOB WASTE VALUABLE TIME, skyrocket production costs. That's why so many mine operators, engineers and foremen specify Boston hose and belting. They know Boston products help boost production by eliminating costly breakdowns and adjustments. Even on the very tough jobs, Boston hose and belting turn in performance you can rely on!

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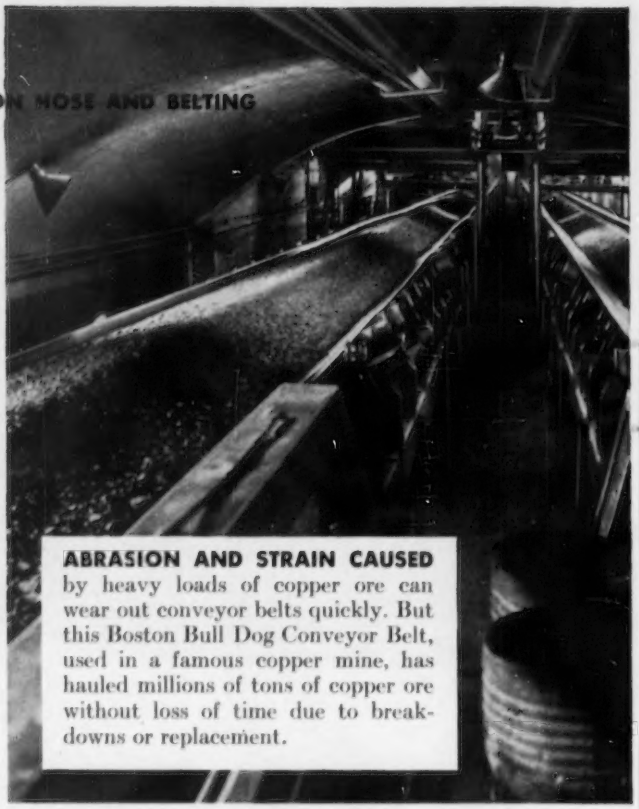
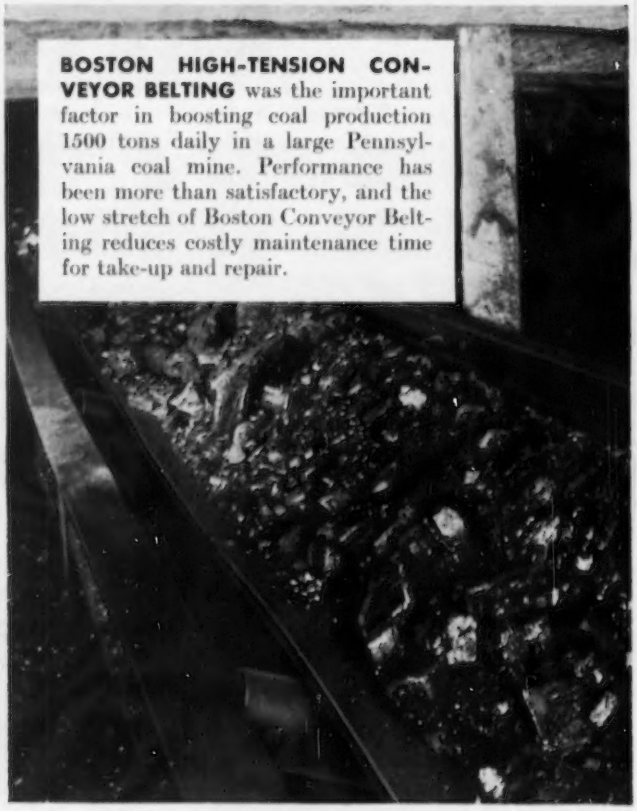
SPECIALISTS IN GOOD SERVICE, TOO. Immediate delivery is no problem for your Boston Distributor. With his thorough knowledge of mining operations and industrial rubber products, he anticipates your needs, prepares to meet them. Better call your local Boston Man today!



ABRASION AND STRAIN CAUSED by heavy loads of copper ore can wear out conveyor belts quickly. But this Boston Bull Dog Conveyor Belt, used in a famous copper mine, has hauled millions of tons of copper ore without loss of time due to breakdowns or replacement.



BOSTON HIGH-TENSION CONVEYOR BELTING was the important factor in boosting coal production 1500 tons daily in a large Pennsylvania coal mine. Performance has been more than satisfactory, and the low stretch of Boston Conveyor Belting reduces costly maintenance time for take-up and repair.

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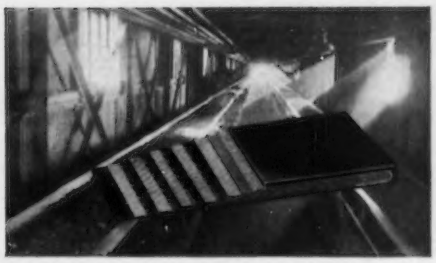
MATTING • TAPE

BOSTON CHECKLIST FOR YOUR HOSE AND BELTING REQUIREMENTS



BOSTON HIGH-TENSION BELTS: Cut your operating costs on long center and high lift conveyors with Boston High-Tension Belts. They need fewer, lighter plies to carry heavy loads. Boston's Rotocure process makes this possible by eliminating mechanical distortions and uneven stretch.

BOSTON CONVEYOR BELTS: Specific job engineering for length of haul and type of load means Boston belts give you outstanding performance on every job. One Boston Silver King Belt still serves a major coal company in Virginia after 20 years (the original drive wore out after 15 years).

BOSTON CUSTOM CONVEYOR BELTS: On special applications, Boston's know-how teams up with Boston's Rotocure process for job-right performance. One specially engineered Boston belt, used by a large iron mine on the Mesabi Range, lasted five times longer than competitive belts!

BOSTON TRANSMISSION AND V-BELTS: You get increased operating efficiency wherever you use Boston Transmission and V-Belts because they are specially designed to eliminate slippage, require fewer adjustments. That means fewer breakdowns, less wear and tear on motors.

BOSTON HOSE: Your Boston Man has a complete line of air hose, water hose, face hose and rock-dusting hose designed and engineered by Boston to give you superior performance, even on the tough jobs. His experience will help you pick the right hose for every application.

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Nevada *(Continued)*

a content of 2.3% which produces a value of $175 per ton. During early operation of the White Caps mine the cinnabar ore was located but not mined due to the low price at that time. Development of that ore is now paying a large share of the cost of getting the principal part of the mine into operation. William R. Noack, of Reno, is president of the company in charge.

Apex Uranium Inc. has a bulldozer and compressor at work on its copper property 65 miles south of Austin, and is breaking through the capping over the vein preparatory to breaking up the ore. A recent spot assay revealed copper content of 21.4%. Work at present is following one of several streaks that broke through the capping. The vein on which the bulk of work will be concentrated for the present is 8 ft thick. The bulldozer is stripping the waste off the surface for about 1,000 ft, and ore will be trucked to Luning, the nearest shipping point, which is located some 60 miles from the site of mining operations.

Austin Uranium's drilling program near Birch Creek in Lander county has encountered an encouraging quartz orebody. At 90 ft the drill began showing a core highly mineralized with lead and iron, and the same strata has continued through a distance of 22 ft.

Nevada Mercury Corp. has just completed modern flotation concentrating and refining plant on the company's property 16 miles southeast of Lovelock. The 100-ton plant is one of the first and largest in Nevada to adopt the flotation concentration process for treatment of mercury ores. A. I. Taylor, president of the firm, says extensive research by top metallurgists has shown the process is most efficient and economical for Nevada mercury ores.

Nevada produced 70,344 lb tungsten during the first quarter of 1956, according to the U. S. Bureau of Mines. The output ranked second only to California. Leading producers were the Wah Chang Mining Corp., in Lincoln County, Getchell Mine and the Riley Mine in Humboldt County; Consolidated Uranium Mines in Lander County, Nevada Scheelite Division of Kennametal Inc., in Mineral County, Gabbs Exploration Co in Nye County, Nevada-Massachusetts in Pershing Company, and the Minerva Mine in White Pine County. Nevada mines produced more tungsten ore than those of any other state, but California is credited with greater production because ore is taken into that state for milling.

Three Kids Mine near Henderson, operated by Manganese, Inc., was the country's largest producer of metallurgical grade manganese according to report of the U. S. Bureau of Mines. Three Kids ore is treated at a large beneficiation plant at Henderson.

WHICH MINER
WOULD YOU
HIRE?
Naturally you would hire the whole man—even so, are you getting the most productive man hours from your section crews? . . . or are your men losing too much time traveling between the lamp house and the face? If the answer is "yes" then let us show you how you can quickly and reasonably install a speedy, safe Connellsville Automatic Man Cage nearer the face—a portable installation which can be moved to a new location, when necessary, with a minimum of time and expense. This man cage will cut travel time up to 50% per man—a big savings in time—a big boost in production when multiplied by individual crew members.
Custom-built to meet your requirements, the two-deck Connellsville Elevator-type Man Cage is fully automatic with push button controls. Installed complete with hoist, controls, counterweight and sheaves at a price lower than conventional methods and equipment.
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"SERVING THE MINING INDUSTRY SINCE 1901"

NEW MEXICO

AEC's new buying station at Grants, N. M., started receiving ore July 5.

The new station was opened to provide a market for limited quantities of limestone and sandstone ores produced in the Ambrosia Lake section and other nearby areas. To assure that a market could be provided all producers in the Grants district, potentially large producers are limited to a reasonable tonnage of development ore pending construction of milling facilities.

Carnotite and roscoelite-type ores are purchased under terms of Circular 5, revised. Other types with suitable metallurgical characteristics and containing not more than 6% lime also are purchased under Circular 5 prices, under terms of individual contracts.

Deduction of $1 per dry tons plus 30c per dry ton for each 1% of lime in excess of 6% is made on high-lime ore.

Sabre-Pinon Uranium Co. and American Metals Co., proposing to build an $8-million uranium processing mill near Grants, announced favorable decision

E. A. GODOY & CO., INC.

New Mexico *(Continued)*

Speed — Strength — Smooth Underrun!

O-B HOLLOW SCREW SPLICERS

Speed—Two-piece clamp body slips easily over burrs and kinks to join any size wire from 2/0 to 6/0 Grooved, Figure 8, or No. 9 Section.
Strength—Four hollow bronze screws clamp body tight, two angled set screws hold wire.
Smooth Underrun—Trolley wire itself is the underrun! When splicing different size wires, simply file down the larger one to preserve that smooth underrun.

Speed — Strength — Smooth Underrun — you always get all three when you standardize on O-B hollow screw fittings for your overhead.

Order Catalog No. 22270 for the splicer shown above.

O-B Hollow Screw Combination Feeder-Trolley Clamp

O-B Hollow Screw Trolley Clamp

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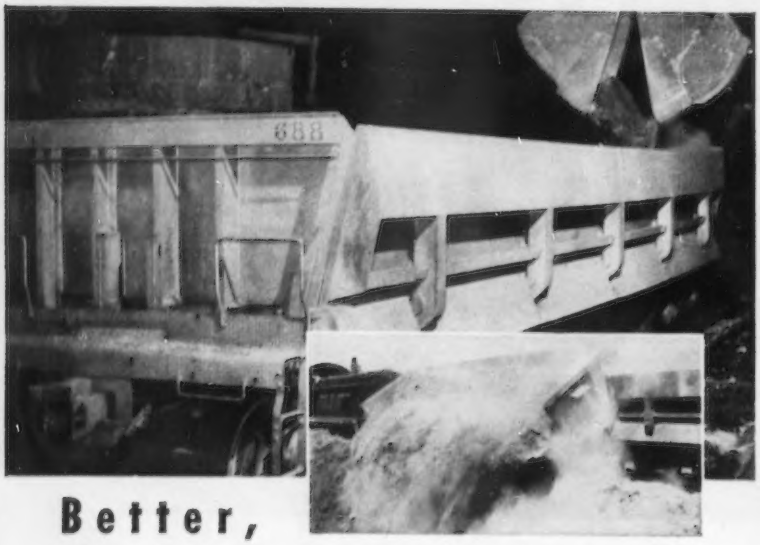
GENERAL AGENTS
FOR
MINING COMPANIES



Better, More Economical ... via DIFFERENTIAL

The yawning bucket drops a huge chunk of waste into this Differential Air Dump Car. Next time the "Sunday Punch" may be tons of reddish hot slag.

For day in, day out service under the rigors of steel mill loading practice, these Differentials perform to the point where steel mills are buying more and more every year.

Unusually rugged design and construction, plus heat resistant floors, when indicated, are part of the answer. Out at the dump it's a matter of seconds to unload completely anything that can be loaded — dumping to either side. It all adds up to better, more economical transportation via Differential.

Send for detailed specifications!

DIFFERENTIAL PRODUCTS INCLUDE: Air Dump Cars, Charging Box Cars, Ingot Mold Cars; Locomotives, Mine Cars, Mine Supply Cars, Rock Larries, Mantrip Cars, Dumping Devices and Complete Haulage Systems.

DIFFERENTIAL STEEL CAR COMPANY
FINDLAY, OHIO

SINCE 1915—PIONEERS IN HAULAGE EQUIPMENT

New Mexico *(Continued)*

from the AEC was expected by Aug. 1.

If the concentrate-purchase contract is signed by that time, the mill should be in operation by January 1958, company spokesmen said.

Eighteen hundred claim location notices were filed in one block by Anaconda Mining Co. in June, McKinley County officials at Gallup reported. Filing fees totaled $3,046.

Mill Progress Report

ATOMIC ENERGY COMMISSION has released a status report on proposed mills in the Intermountain Area:

Ute Milling Co., in negotiation with decision imminent. Subsidiary of Atlas Corp. plans concentrator at La Sal, San Juan County, Utah, serving Big Indian District.

Lucky Mc Uranium-Utah Construction Co., proposal for mill in Gas Hills, Wyo., area, under negotiation.

Los Creek Uranium Co., proposal for mill in Gas Hills-Crooks Gap area. Under negotiation.

Texas Co. with New Jersey Zinc Co., a mill at Mexican Hat, serving White Canyon District, San Juan County, Utah. A proposal.

Expansion of the mill at Salt Lake City of Vitro Corp. of America (Vitro Uranium Corp. a division)—In discussion.

NORTH CAROLINA

Five geology professors have been employed on a temporary basis by the North Carolina State Department of Conservation and Development to help complete mapping of areas of the state not yet mapped, it is announced by Dr. J. L. Stuckey, state geologist.

Their work is in connection with the first complete geological map of North Carolina made since 1875, work on which has just been begun under a $35,000 allocation made available by Gov. Luther H. Hodges for the work.

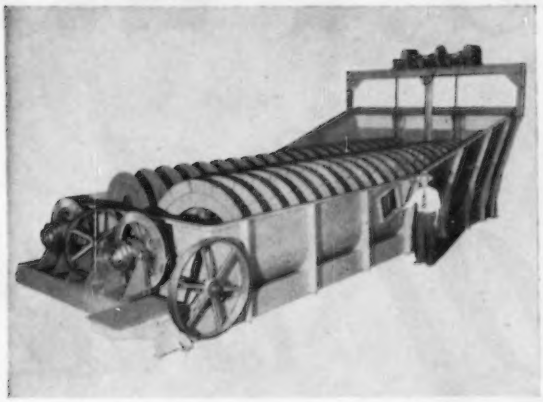
The five geology professors, each of whom has an assistant, hired for the work include: Dr. W. A. White, professor of geology, Dr. Virgil I. Mann, associate professor of geology, and Dr. Roy L. Ingram, associate professor of geology, all of the faculty of the University of North Carolina; Dr. S. D. Heron, assistant professor of geology, Duke University; and Dr. John M. Parker, professor of geology at N. C. State College.

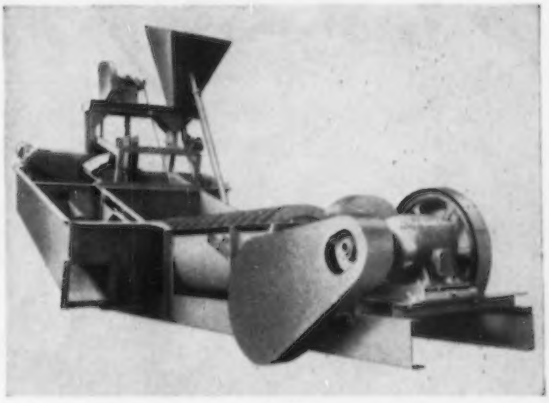
Areas in which they and their assistants will work include sections of the state extending from Person and Warren Counties on the Virginia line to Richmond and Anson Counties on the South, Dr. Stuckey said.

When the professors complete the mapping of the areas assigned to them, Dr. Stuckey and his assistant, Sam D. Broadhurst, and the U. S. Geological Survey, will cooperate in putting the

COST CUTTING EQUIPMENT

AKINS CLASSIFIERS AND HEAVY MEDIA SEPARATORS

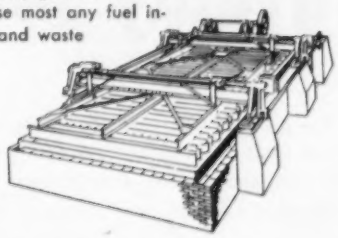




The Akins Classifier was originally developed, in 1908, for use in closed circuit with a ball mill. Its outstanding success led to many other profitable applications where it has demonstrated its superiority... dewatering and recovering fine solids; sand and slime separations; washing coal, sand, and oyster shell; desliming and de-oiling phosphate rock and concentrate; sink-float concentration; and many others. The Akins is made in sizes up to 84", simplex and duplex, in two types—small and large settling pool. The Akins Heavy-Media Separator is the only unit available which can make a 3-product separation in one machine from one medium cleanup circuit.

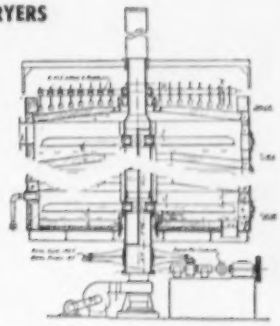
LOWDEN DRYER

For drying flotation concentrates, graphite, clays, ground minerals, paint fillers, pigments, various precipitates. Can use most any fuel including live steam and waste heat.



SKINNER ROASTERS AND DRYERS

For roasting, calcining, and drying ores, clays, limestone, limestone mud, flotation concentrates, decomposing oil sludge in the process of recovering sulphuric acid. Coal, oil or gas fired. Sizes to 23'6" inside diameter; up to 12 hearths.



VEZIN SAMPLER

A continuous sampling device generally used for 5 and 10% cuts on crushed feed. Alloy white iron cutting lip. Rubber or abrasion resistant plate lining inside. Compact direct driven faced tooth bevel gear drive. Easy addition of mixing barrel, operated from same drive.

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A SUBSIDIARY OF THE MINE & SMELTER SUPPLY CO.

Why is P&H *of the*

MAGNETORQUE* and ELECTRONIC the only modern

These revolutionary advances in design and performance of electric shovels are just two of the reasons why operators and owners are pointing to P & H for their outstanding achievement in electric shovels . . . why P & H now is at the head of the Big Three . . . why P & H can promise you the only modern electric shovel.

Just think! Power transmission *without friction's* in massive electric shovels. Boosts efficiency. Cuts maintenance and operating costs. *This is Magnetorque.* Exclusive with P & H.

Just think! Complete control of dig, hoist, swing and propel of these giants with simple stepless control. 12% faster cycles; 16% savings in operating time. *This is Electronic Control.* Exclusive with P & H.

For complete information, call your P & H representative. Electric Shovel Division, Harnischfeger Corporation, Milwaukee 46, Wisconsin.

For Modern Engineering, Look to

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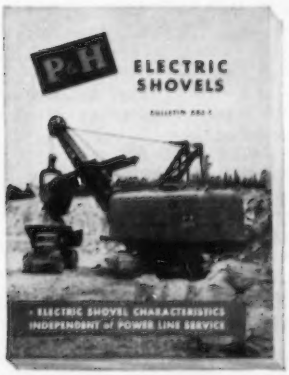
ELECTRIC SHOVEL DIVISION

at the head Big Three?

CONTROLS give operators electric shovels

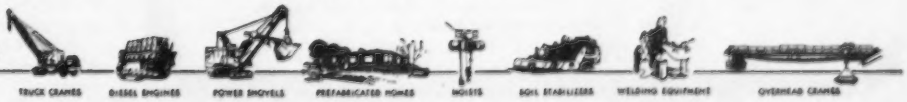


For a clearly illustrated description of Magnetorque* and how it sets a new standard for electric shovel design and operation, write for Bulletin X-156. Other booklets available on electric shovel models from 3 to 10 cu. yd. capacity. A copy of these publications will be sent those who request it on their company letterhead.

*T. M. of Harnischfeger Corp. for Electro Magnetic Type Coupling

CORPORATION *Milwaukee 46, Wisconsin*

the P&H *Line*



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Greensburg storage battery locomotives

5 TON HIGH TYPE MONITOR

Available in 3 to 12 tons: 42 to 48" high, 18 to 56½" track gauges.

Greensburg's dependable performance results in operating economy. Advanced engineering design and custom-building to specifications give Greensburg Locomotives up to 20% more efficiency and longer battery life than any other storage battery locomotive of equal weight and battery capacity. More earning power per dollar invested!

Built in single or double motor drives with double equalizers, drum or contactor type controllers, with or without dynamic braking, Greensburg Locomotives will haul more and cost less to operate!

Send us your haulage problem today!

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Every kind in stock

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North Carolina *(Continued)*

material together and evaluating it.

Funds were set aside by the Governor for the mapping after the State Board of Conservation and Development adopted a resolution citing the need for a complete geological map of the state in the promotion of further development of the state's mineral resources.

OREGON

Mortgages totaling $44-million to cover Harvey Aluminum Co. plant at The Dalles, Ore. were recorded Monday July 2 at the county courthouse of Wasco County, Ore., signaling plans of Harvey Machine Co., the parent corp., to get construction of the firm's primary smelting plant started by Aug. 1.

Recorded were $22-million plus interest to Sept. 30, 1965 in name of Bank of America National Trust and Savings Assn. and two mortgages of $11 million each in name of Manhattan Bank and First National Bank, both of New York City.

Harvey Machine agrees to pay off the obligations and posted the land west of The Dalles river front facilities as security. Bonneville power contracts and General Services Administration aluminum stockpile purchasing contracts were made a part of the record.

Bonneville had extended its construction start deadline to Aug. 1. Plant must be operative late 1958.

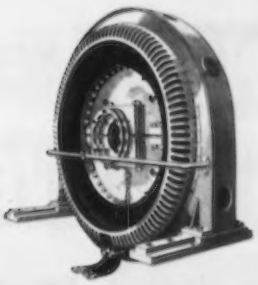
Oregon's woman gold mine owner, Mrs. Gladys Laycock, Prairie City, has filed suit in Federal District Court in another round of her battle with the Federal Government's $35 an oz price for gold.

Attorneys Norman Easley and Stewart Whipple explained that the suit in equity for an injunction seeking to enjoin Treasury Secretary George M. Humphrey from enforcing regulations which pegged the price and made the U. S. Government the sole buyer is a natural sequence of the earlier legal moves. Other court appeals have failed.

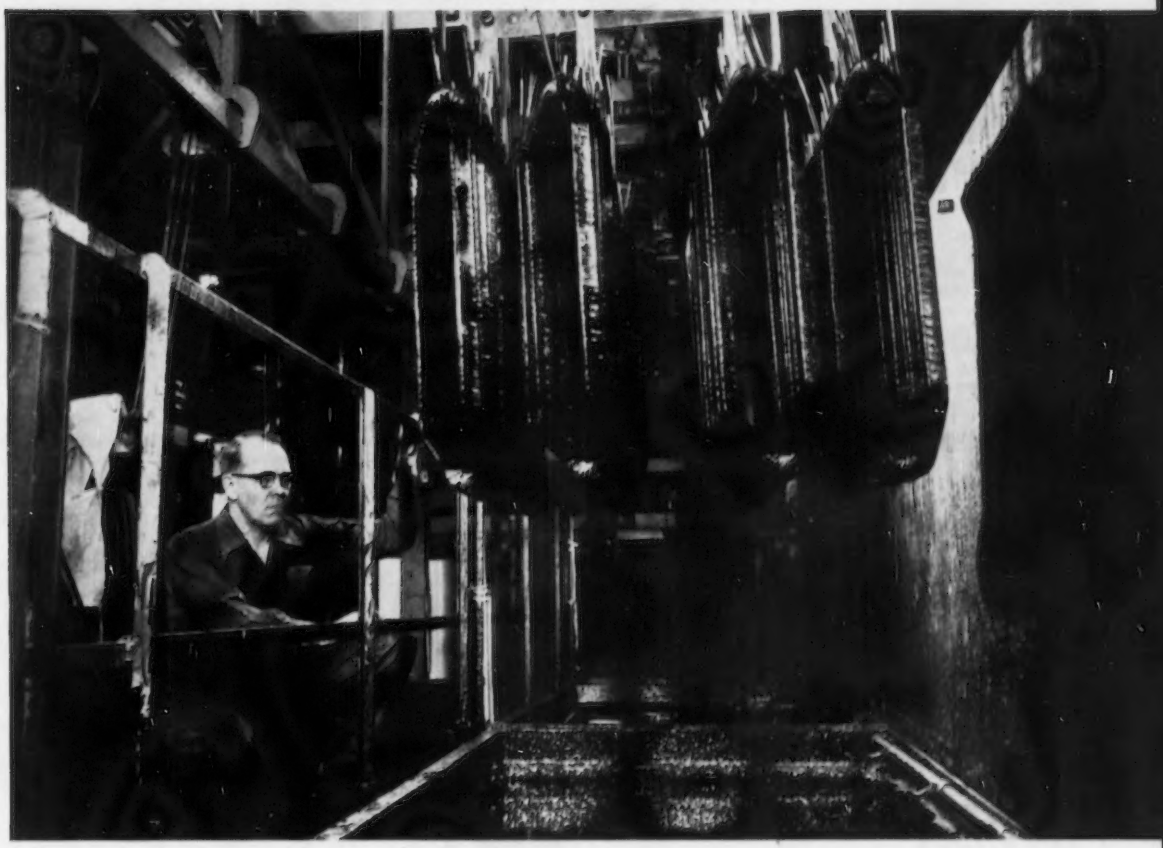
Chromite mining activity in southern Oregon, major U. S. domestic source of the ore concentrates purchased by western GSA depots, has been given a green light for further extensive development as the result of announcement that the Government's purchasing program would continue through June 30, 1959.

Arthur S. Fleming, director of defense mobilization told former secretary of the interior Douglas McKay he had advised the house committee on insular affairs "the Department of the Interior has advised us that continuation of the program until the entire quota of 200,000 tons has been purchased may serve to develop a significant mobilization base. Therefore I have authorized the General Services Administration to extend the program until June 30, 1959."

Hollis M. Dole, director of the Oregon department of geology and mineral industries, said the extension means im-



HOW G-E SYNCHRONOUS MOTORS
REDUCE MAINTENANCE COSTS



An insulating bath helps fight moisture

Moisture has the unhappy habit of working its way through motor coil insulation and reducing its capacity to withstand voltage stress. To guard against exasperating production-line shutdowns, General Electric seals coils with a coating of high-grade insulating resins. This seal is applied by a conveyor belt dip and bake system.

It works like this. After the main body of insulation is applied in the form of tapes and films of non-hygroscopic materials, each set of coils is placed on a conveyor and dipped in a bath of special, synthetic insulating materials. This way the coating is uniformly applied. Then the conveyor carries the coils into a huge oven and cures them for a specific length of time. The cycle is repeated until the proper seal is built up. Each step is automatically and precisely controlled—length of dipping and baking time and temperature.

This means the coils on your G-E synchronous motor are protected by a hard, tough insulation with high dielectric strength and high resistance to moisture and contaminants. Its glossy surface makes the coils easy to clean too.

All this adds up to less maintenance and down-time. For more information on G-E synchronous motors, contact your nearest General Electric Apparatus Sales Office or write Section 775-4 for Bulletin GEA-5332. General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

WEIGH WITHOUT STOPPING
WHILE YOU CONVEY

Yes, weigh and record with the —MERRICK
WEIGHTOMETER

The Merrick Weightometer provides a continuous, automatic, accurate weight record at any designated point in the mill, while material is in motion on conveyor. It weighs without interrupting conveyor service. Applicable to any size belt conveyor, horizontal or inclined. An accurate and dependable means of keeping constant check on production.

MERRICK SCALE MFG. CO. PASSAIC N. J.

Oregon *(Continued)*

portant prospects may be developed which otherwise might be lost forever or "be exorbitantly expensive to reopen."

Most of the mines in southwestern and central Oregon are manned by crews of four or six, and Dole reported about 100 men were employed directly the past season in the mining of chromite.

Paul L. Crooks Sr., Portland contractor who has built large housing projects in the Anchorage, Alaska area, has been elected president of Uranium Corporation of America, a Montana corporation wholly-owned by Portland businessmen. The election, at a Portland, Ore., meeting in June, followed reorganization of the firm's holding in Montana, Nevada and Alaska where the corporation claims it holds mineral leases on about 4,000 acres of patented and unpatented claims.

The other officers are: Al Mather, Portland, vice president in charge of property acquisition; Orval W. Sorensen, vice president in charge of real estate; William B. Murray, vice president and general counsel; David E. Loughran, vice president and chief engineer; William F. Meyer, CPA, secretary; James R. Miller, business analyst and assistant secretary.

A company spokesman reported the firm makes no claim it holds leases with uranium prospects although some of the property has been under investigation and others have been gold, silver and copper producing lands in the past and are presently inactive.

UTAH

Sidney Mining Co. and Mascot Mines Inc. have started production at their joint-venture Colorado River uranium mine in San Juan County, Utah, and are shipping to the Moab buying station under a purchase contract with the Atomic Energy Commission. About 2,000 tons of 0.46% ore have been outlined by drilling on the property and additional tonnage is expected to be found as mining progresses.

The two companies are also engaged in an exploratory drilling program on the Crawford claims in southern Stevens County, Wash., just north of the Spokane Indian reservation on which the best ore deposits in the Washington area have been found.

Malcolm C. Brown, president of Sidney for the past two years, was also elected president of Mascot Mines at a recent special meeting of stockholders. The meeting also ratified a proposed amendment to Mascot's articles of incorporation reducing the par value of the shares from 35c to 17½c and increasing the number of authorized shares from 1.75-million to 3.5-million. Purpose of the action was to place the company in position to raise additional funds for expanding its activities.

Sidney and Mascot have been associated in several uranium ventures during the past 18 months and they have adjoining zinc-lead mines in the Pine Creek area of the Coeur d'Alene District.

Silver Dollar Mining Co. reports that two diamond drill holes have encountered good uranium ore at a depth of about 120 ft on its recently-acquired prospect on Fry Mesa about 50 miles west of Blanding in San Juan County.

Stockholders of the Tintic group of companies have ratified contract with Bear Creek Mining Co., leading to multi-million dollar probe for nonferrous metals in Utah's East Tintic District.

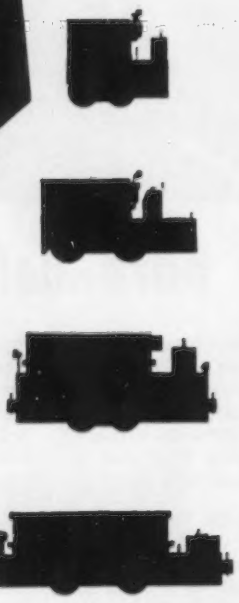
Directors of Chief Consolidated Mining Co., other major partner to the pact, had previously resolved to sign. Signature was scheduled first week in July.

Members of the Tintic group are: Tintic Standard Mining Co., South Standard Mining Co., Eureka Lilly Consolidated Mining Co., and Eureka Standard Consolidated Mining Co.

Within the Tintic group, any net profits would be divided as follows: South Standard, 34%; Tintic Standard, 32%; Eureka Standard, 20% and Eureka Lilly, 14%.

The Chief-Tintic group would receive 37½% of any net in profits after payment of costs. If ore is on Chief ground, that firm would receive 66⅔% of the 37½% and Tintic Group, 33⅓%. Ore produced from Tintic Group ground, the formula would apply the other way around.

BUILT TO SUIT!



ATLAS builds storage battery locomotives to suit "actual" conditions of your operation . . . still using standard, field-proven parts. Ask for a quote on a "special" design and be surprised how easily and economically you can get a machine built to "suit" your needs.

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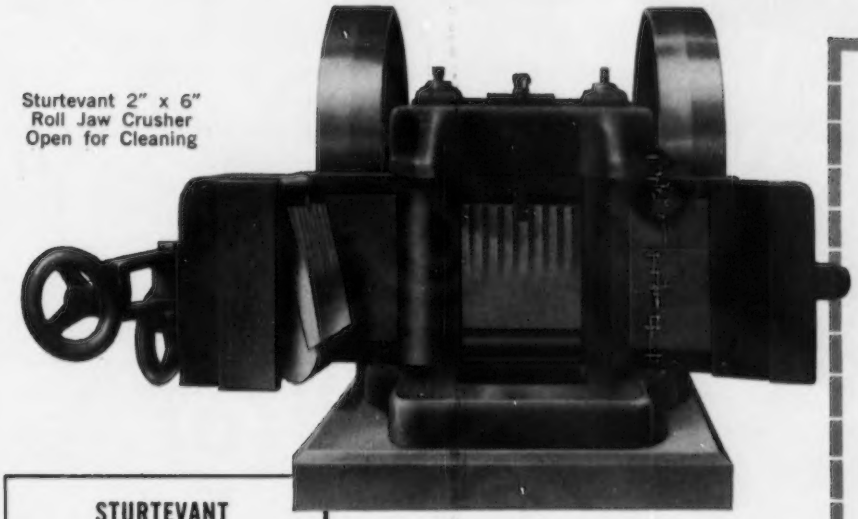
"OPEN-DOOR" DESIGN CUTS SAMPLING TIME



Sturtevant 2" x 6" Roll Jaw Crusher Open for Cleaning

STURTEVANT LABORATORY EQUIPMENT

ROLL JAW CRUSHER

First choice for hard rocks. Jaw opening — 2 x 6 in. Approx. capacity: ⅛ in. setting — 700 to 800 lbs. per hr.; ¼ in. setting — 1000 to 1200 lbs. per hr.

CRUSHING ROLLS

Two sizes: 8 x 5 and 12 x 12. Outputs range from ¾ in. to 20 mesh at capacities from ¼ to 10 tons per hr. Performance varies with materials.

SWING-SLEDGE MILLS

For pulverizing soft, hard, tough or fibrous materials ranging from 1 in. to 20 mesh. Feed opening — 5 x 6 in. Capacities at 250 lbs. to 1 ton per hr. for 10 mesh, depending on materials.

SAMPLE GRINDER

Produces samples between 10 and 100 mesh with simple handwheel adjustments. Capacity up to 200 lbs. per hr. with ¼ in. or finer feed.

Small-Scale Duplication of Full-Scale Production

All Sturtevant Laboratory Equipment is ruggedly constructed. So much so that it is used in regular plants for round-the-clock operations. Exclusive "Open-Door" design makes cleaning and maintenance between sample runs quick and easy.

Preferred by laboratories that are proud of their work. Users of Sturtevant Laboratory Equipment represent the "blue chips" in industry and education. Names on request. Check the coupon for full information.

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The "OPEN DOOR" to *lower* operating costs over *more* years

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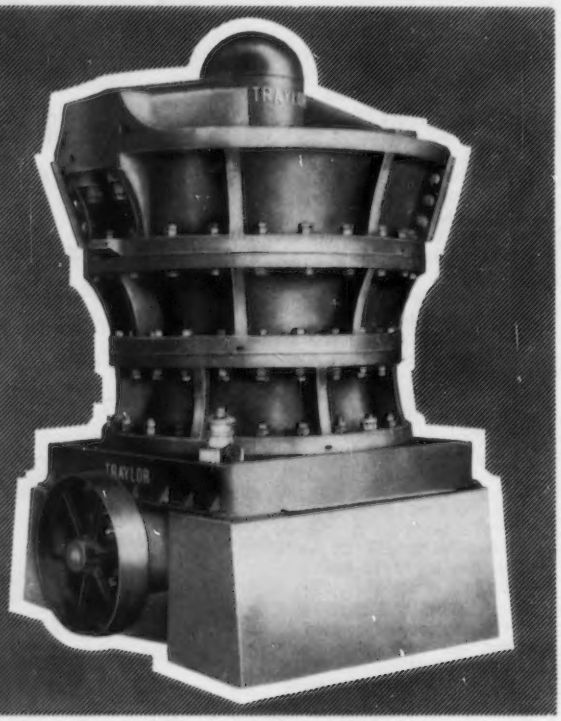
ASSURE TOP CAPACITY PRODUCTION FOR PRIMARY ORE REDUCTION

The huge productive capacity of Traylor TC Crushers is a matter of record throughout the mining industry. This enviable reputation is due to the many design improvements pioneered and perfected by Traylor engineers over more than fifty years. The Traylor TC's massive construction provides superior shock absorption that stands up to the heaviest production schedule without frequent down-time. Bronze bushed eccentric bearing, Timken-mounted countershaft and an outside auxiliary lubrication system are typical of the many TC features that assure peak production and economy in primary ore reduction.

TC Gyratory Crushers are "Traylor-Made" in 7 sizes with feed openings from 20" to 60" . . . capacities range from 1240 to over 32,000 tons per 8 hour day. For complete specifications, details and diagrams, write for your free copy of Traylor Bulletin No. 126.

Traylor Self-tightening bell head and curved concaves reduce choking by increasing the capacity of each succeeding zone in the crushing chamber. Lower power costs per ton produced result from application of the power as a direct crushing force. This also reduces slippage between material and crushing surfaces . . . thus greatly increasing the life of concaves and heads.



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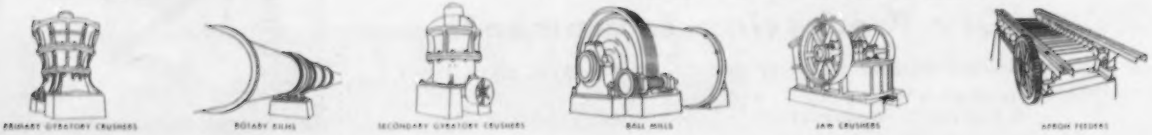
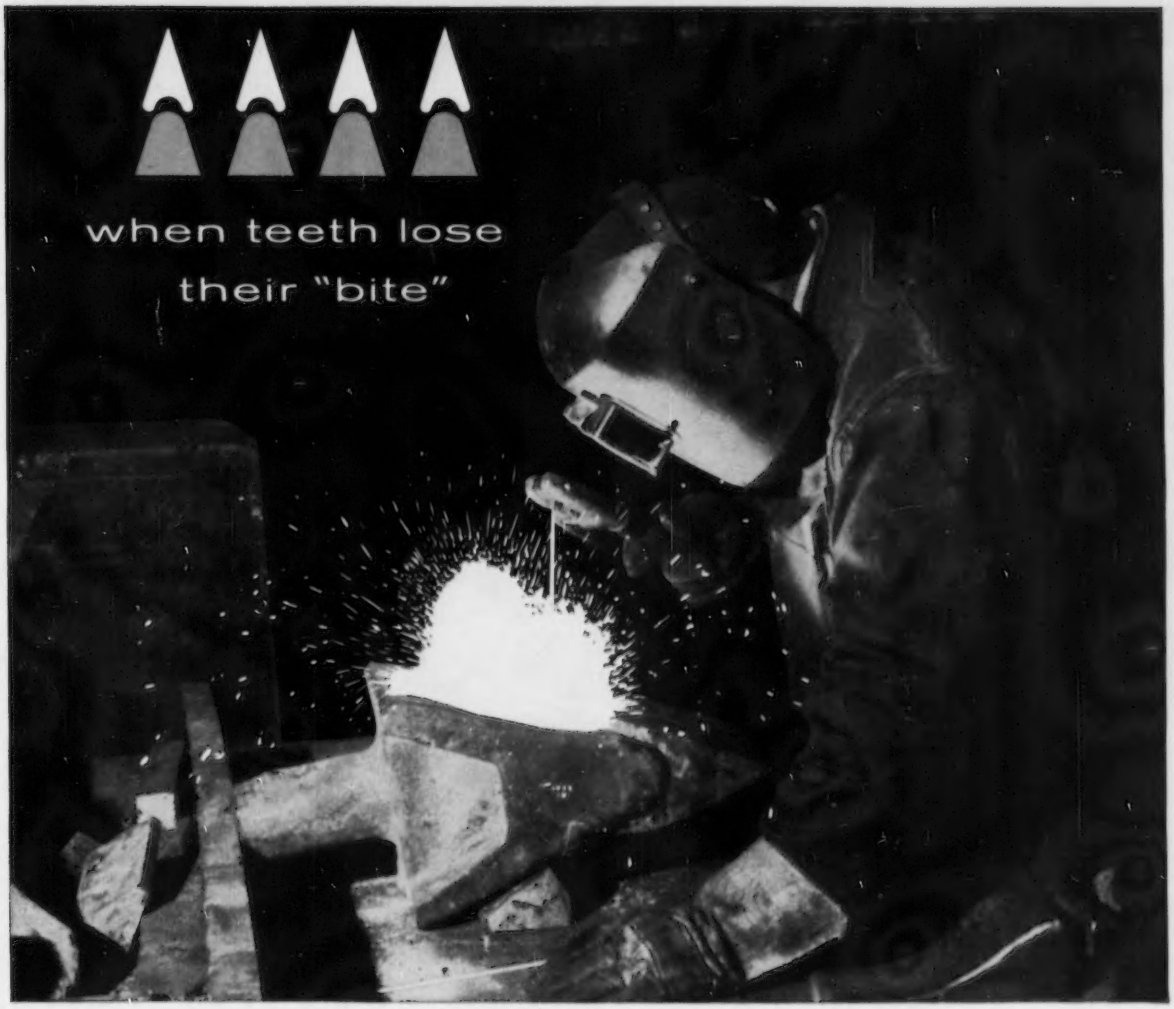




It's a **15-MINUTE REBUILDING JOB** with Amsco® Cast-to-Shape Repointers

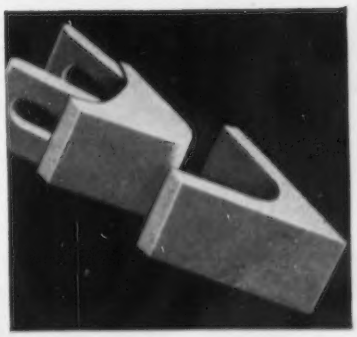
Easy to weld on . . . add strength and service life to entire tooth

Where dipper-tooth wear is moderate, and where digging conditions are not too severe, Amsco Cast-to-Shape Repointers provide a cost-saving answer to tooth replacement.

An average-size tooth can be completely rebuilt in about 15 minutes. The repointer overlaps the tooth top and bottom and is easily welded in place, using only a few electrodes.

Cast of Amsco Manganese Steel, with "ears" that protect the flat sides of the tooth, these repointers add strength and service life to the entire tooth. Available as individual repointer units, or in bar lengths.

For heavy digging, use Amsco "Wear-Sharp" Repointers or Repointer Bars. Order Amsco Repointers from your nearby Amsco Distributor.



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VENT LINES
...the Easy Way!

Naylor Spiralweld pipe is "made-to-order" for ventilating jobs in mining service.

Its light-weight makes for easy handling. Installation is fast . . . especially with the one-piece Naylor Wedge-Lock coupling which can be joined with only a hammer. Lines hug the wall . . . can be assembled with only one side of the pipe in the open . . . and extended readily as work progresses.

You save money, too, because the greater collapse strength inherent in the Naylor structure permits the use of lighter gauge material without sacrifice of performance.

Write for the complete story. Ask for Bulletins No. 507 and No. 514.

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Utah *(Continued)*

Bear Creek also is continuing negotiations with a number of smaller firms with fringe acreages.

Work, including sinking of a 1,000-ft, multiple-compartment exploration shaft and diamond core drilling, is scheduled to commence immediately after signature of contracts among the Utah mining companies and Bear Creek.

White Valley tungsten mill of Utah Chrome Co. and the Comstock Uranium & Tungsten Co. scheduled commencement of operations of a 100 tpd concentrator, July 5.

Mill will process output of the two companies' mine at Pine Peak 55 miles west of Delta. White Valley is 70 miles west of Delta.

Target date for full operation of all circuits at rate of 250 tpd is planned for October, according to C. G. Cafarelli, Comstock president.

Federal District Judge Willis W. Ritter has confirmed Standard Uranium Corp. and others in ownership of seven ore-bearing uranium claims in Big Indian District, San Juan County. The Salt Lake trial in which Shawano Development Corp., New York City was plaintiff, lasted three weeks.

Judge Ritter based findings in part on premise that Plaintiffs failed to convince the court that defendants' discovery monuments were placed in 1948 in the wrong locations.

Western Silver-Lead Corp., Square Deal Mining & Milling Co., and Uranium Mines Inc. have penetrated a 3-ft thickness of commercial-grade uranium ore in two of the seven drill holes recently put down on their Phoenix claims in the Big Indian District of San Juan County, adjoining Homestake Mining Co.'s Alice property on the north. The two drill intercepts are about 400 ft apart, at a depth of approximately 550 ft, officials reported.

Four Corners Uranium Corp., Grand Junction and Denver, is completing contracts with Vitro Uranium Corp., a division of Vitro Corp. of America, covering disposition of ore mined in Utah's Green River district.

Four Corners previously had application in with AEC to build a concentrator at Green River.

Subsequently, the AEC granted Union Carbide Nuclear a contract to build a new mill at Rifle and up-grader circuits at Green River and near Slick Rock, Colo.

Production by Four Corners' lessors and affiliates in Green River area has been rated at more than 200 tpd by Four Corners president Eugene Sanders.

The ore would go to Vitro's mill at Salt Lake City.

It is contended by those close to the contract that it virtually eliminates last major, uncommitted, ore area in Emery County, Utah, from service to Union Carbide Nuclear's proposed up-grader.

Output from the Temple Mountain district and the Delta Mine of Hidden Splendor Mining Co. (Atlas Corp.) is be-

New Stoper Drill Design Combines 30% Reduction in Weight with 10% Faster Drilling Speed

Use of modern materials in new Le Roi-Cleveland S-10 Stoper results in easier handling.

With the introduction of the new Le Roi-Cleveland S-10 Stoper, great strides have been made in easing the work-load of miners. At the same time, their productivity, in terms of footage drilled per shift, has been increased.

New stoper uses aluminum feed leg to help decrease weight as much as 30% and provide better balance. This type of feed leg, already so successful on Le Roi-Cleveland Air Legs, contributes greatly to weight reduction: The S-10 with 18-inch steel change weighs only 79 lbs!

10% faster drilling speed results from a combination of design features: The new valve is timed and ports are arranged so that a maximum flow of air is delivered to the piston on both downstroke and upstroke. Hard-hitting, rock-shattering blows result, along with a rotation that's strong enough to turn the steel in the worst kind of drilling.

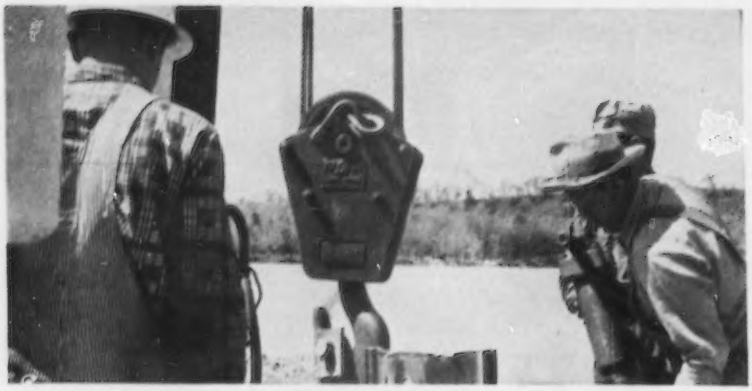
The variable feed-pressure control also adds greatly to the performance of the S-10. It has a wide enough range to feed the machine properly against all kinds of rock. Maximum drilling speed is attained. At the same time, both bit life and machine life are increased.

Exclusive steel puller permits the use of collared steel. This is of special advantage in tight ground, where stuck steels used to be a problem. The new steel puller, consisting of only 5 parts, also makes stoper operation safer. Since the steel never leaves the machine, the danger of falling drill steel is eliminated. The new S-10 Stoper is also available with tappet-type construction for shankless steel.

Three sizes of feeds are available. The S-10 can be supplied with 18, 24, and 30-inch steel changes for ⅞ and 1-inch hexagon or quarter-octagon steels, with or without collared shanks.

LE ROI Division of Westinghouse Air Brake Co., Milwaukee 1, Wisconsin, manufacturers of Cleveland air tools, Tractair, portable and stationary air compressors, and heavy-duty industrial engines. Write us for information on any of these products.

RD-83



SAFETY'S ALWAYS IN SIGHT

Ever worried about your crew forgetting the rated capacity of a block? You're free from worry and they're free from danger with Crosby* "Load-Rated" Blocks because the load capacity is *embossed* in the side plates! A quick glance shows what the limits are—no chance to overload the block by mistake. Crews the world over are protected by genuine Crosby "Load-Rated" Blocks—are yours?

*REGISTERED TRADEMARK

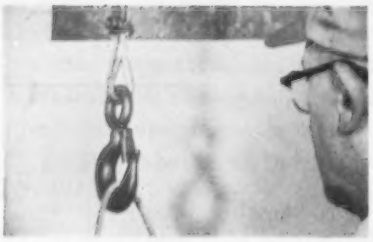
THE RIGHT COMBINATION

An exacting combination of design, steel and drop forging goes into Laughlin Shackles. A combination that results in maximum strength without brittleness that can result in fracture under shock load or in extreme cold! Pins used in Laughlin Shackles are forged from the same high quality steel—their extra hefty design makes them safer when shock loads accidently occur. When you see the famous Laughlin trade mark on shackles (and all other Laughlin fittings), you're seeing the mark of safety! Your nearby distributor has shackles in sizes from 3/16" to 3".

Double Clevis Link attaches 1/4" to 1/2" chain to rings, end and sling links, eye hooks, pad eyes, tractor eye bolts and other fittings.

The world's most complete line of fittings for chain and wire rope is described in the catalog available from your distributor.

LOADS STAY PUT!



Anyway you handle it—rough or easy—your load won't come off a Laughlin Safety Hook until *you* release it! The hook is drop forged and heat treated. The fool-proof latch mechanism is made of long life stainless steel or bronze—it'll never rust, never jam! See your Crosby-Laughlin distributor for information on sizes and capacities.

LAUGHLIN LINKS INSTALLED QUICKLY

Lower downtime—fast changeover is reported by companies using super safe Laughlin Double Clevis Links to couple standard and alloy chains to fittings. Users everywhere have cut out expensive, time-consuming welding and blacksmithing in favor of simple installation. Laughlin's heat treated

Stocked and sold by leading distributors everywhere

CROSBY-LAUGHLIN *Division*

American Hoist and Derrick Company

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Utah *(Continued)*

ing shipped to the Salt Lake facility.

Tungsten refinery of Salt Lake Tungsten Co. at Salt Lake City has been placed on a stand-by basis pending passage of an interim stockpile purchase program by Congress.

Blair Burwell Sr., president of the joint affiliate of Minerals Engineering Co. and Sylvania Electric Products Corp., said operations would be resumed as soon as the legislation is signed by President Eisenhower.

He anticipates this will be done by last week in July or first week in August. The refinery produces about 8,000 units monthly of WO_3.

Federal Uranium Corp. of Salt Lake City has advanced Radiogeophysical Corp., San Antonio, Tex., $150,000 over a three-year period for purposes of an intensive prospect of uranium fields in Blanding area of San Juan County, Utah.

The loan is secured by productive properties in the region in which Radiogeophysical has interests or control.

W. D. Nebeker Jr., Federal president, said the deal calls for Federal to be operator on any commercial finds made by Radiogeophysical.

Pilot runs at the $8-million mill under construction at Moab for Uranium Reduction Co. are expected to begin about Sept 1. Material shortages caused by strikes in supply industries slowed construction during the spring.

Sinking of a 600-ft two-compartment shaft in the Big Indian district was started in late June by Gene Bishop, Inc., of Grand Junction, awarded the contract by Lisbon Uranium Corp.

The shaft, to be known as the "Ike," will cost about $250,000 and is scheduled for completion by Dec. 31. Lisbon president A. P. Kibbe, said the "Ike" would tap 135,000 tons of ore assaying over 1% uranium oxide.

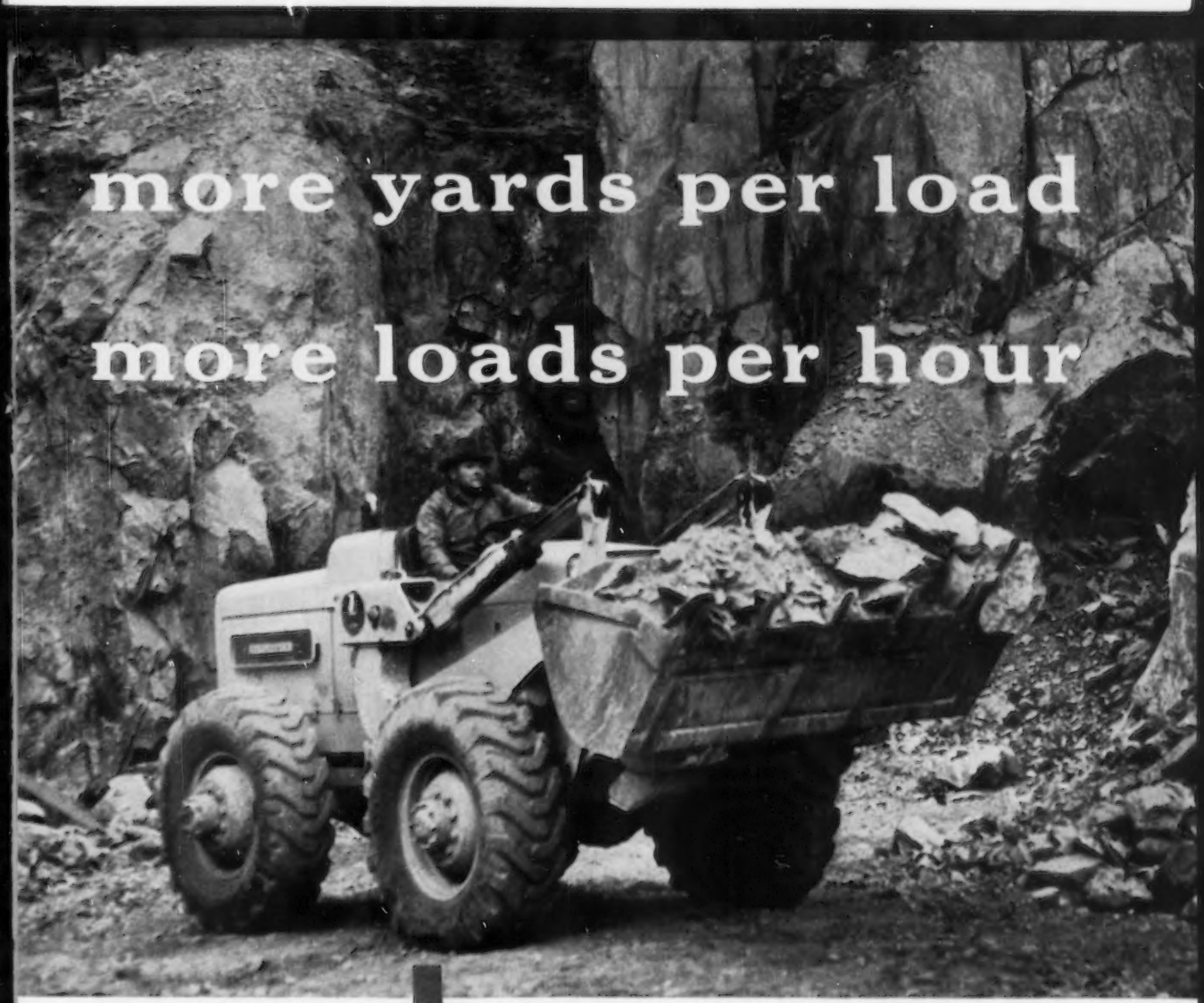
Lisbon is controlled by Atlas Corp. Hidden Splendor Mining Co., another Atlas subsidiary and operator of the "Far West" shaft in the Big Indian district, is supervising engineering for Lisbon.

Utah had 754,000 tons of uranium ore stockpiled at Government buying stations as of April 30, according to official figures made public early in July.

Total stockpile at buying stations in five western states was 2.4-million tons, the report said. Utah had 754,000 tons at Monticello, Marysvale, Moab and White Canyon. New Mexico had 290,500 tons at Grants and Shiprock. South Dakota had 95,000 tons at Edgemont, Wyoming had 69,000 tons at Riverton, and Arizona 39,750 tons at Globe and Tuba City.

Utah also leads in total production, the report said. New Mexico was listed as second and Colorado third. Other states in order of production were Arizona, Wyoming, South Dakota, Washington, Montana, California and North Dakota.

See p 122 for a discussion of uranium reserves and production in the U. S.



Gets More

A combination of powerful "pry-out" action using breakout pads as a fulcrum for leverage and a 40° bucket tip-back *at ground level* gets BIGGER LOADS with less spillage.

Keeps More

Heaped loads are cradled closer and lower for greater stability while carrying. Exclusive load shock-absorber also cushions load, smooths the ride, and permits faster movement with less spillage.

Delivers More

Since you get MORE to begin with and keep MORE while traveling at higher speeds . . . with less spillage in both instances . . . the result—you *deliver* more yards per load and more loads per hour.

Whether you need maneuverability and digging power for scavenging operations like this, or want to rehandle and load ores and concentrates "PAYLOADER" tractor-shovels are designed to get and hold bigger loads and deliver them faster.

"PAYLOADER" superiority on materials handling at mine, mill and smelter is the result of 34 years of pioneering and leadership in tractor-shovel manufacture. "PAYLOADER" preference in the mining industry also comes from the fact that "PAYLOADER" is a complete proven line — a size and type to best meet each need—PLUS the finest parts and service facilities at the nearby "PAYLOADER" Distributor.

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Send data on "PAYLOADER" Tractor-shovels

- ☐ 4 wheel drive types to 2¼ cu. yd.
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At the turn of a dial, the furnace operator can set the required total Btu input for a multiple-fuel open hearth furnace.

Honeywell Metered Fuel-Air Ratio Control *Saves Fuel Dollars*

Fully automatic systems cut costs on single, alternate, or combined fuel-fired installations.

HONEYWELL metered fuel-air ratio control systems on your furnaces will get the maximum Btu's from available fuel. Moreover, in addition to saving fuel dollars, these systems are designed for operating convenience.

For example, an operator can check firing conditions by merely glancing at the large, easily-read charts and scales on the *ElectroniK* controllers. With the turn of a knob, he can set up automatic Btu input control, or switch over to manual control for startup or emergency operation.

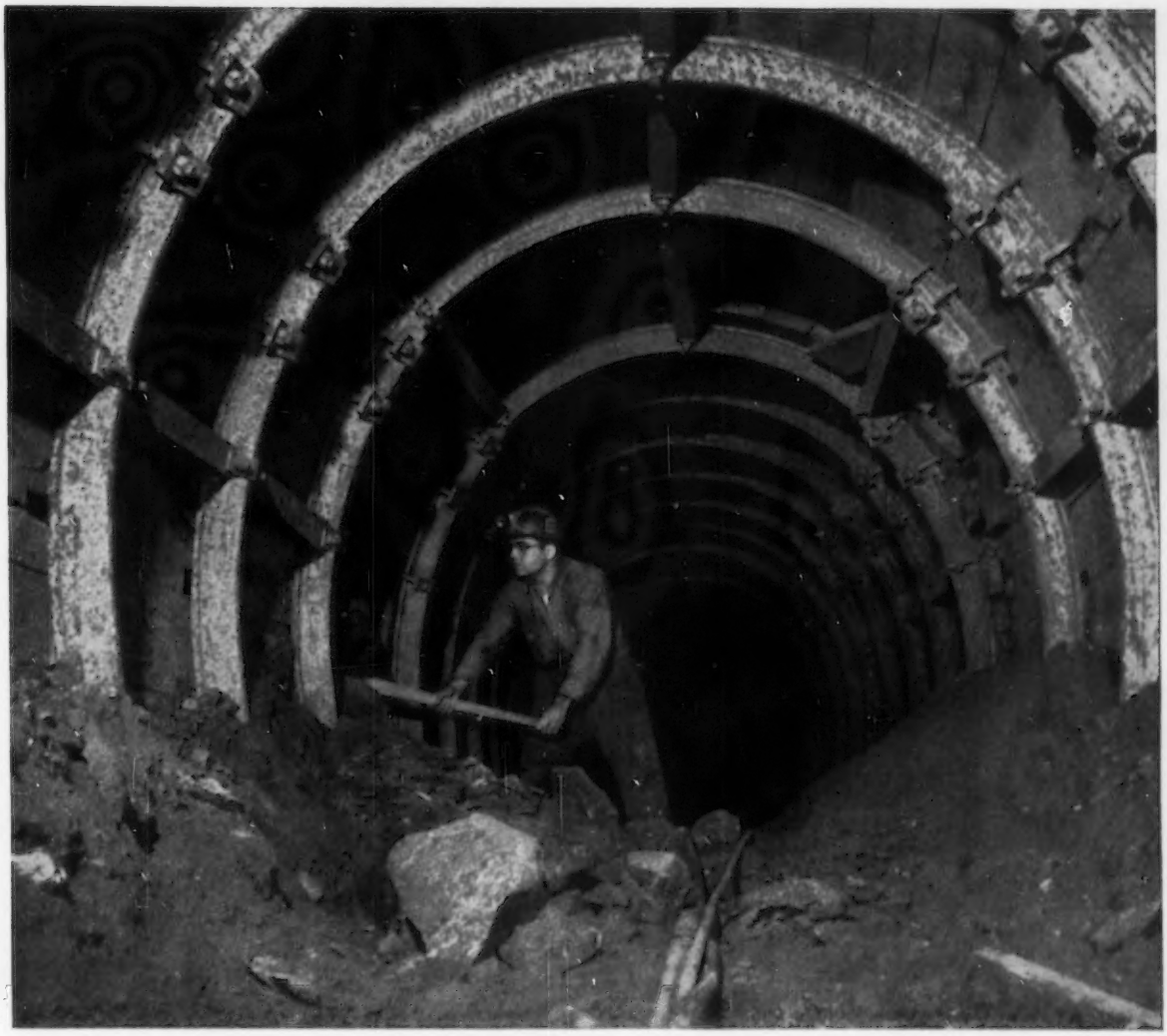
Honeywell metered fuel-air ratio control systems are, fundamentally, fuel savers, and are applicable to gas, oil, tar, pitch, air, or steam flow measurement and control. They provide direct and immediate indication of set points and ratio settings. Where panel space is limited or where graphic centralized panel operation is desirable, Honeywell miniature *Tel-O-Set* instruments can be supplied in these systems.

Each system is individually engineered to your specific furnace and fuel requirements. For a discussion of what Honeywell metered fuel-air ratio systems can do for you, call your local Honeywell sales engineer . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

● REFERENCE DATA: Write for Data Sheets No. 4.3-4a, "Fuel-Air Ratio Control Systems"—and No. 6.4-12, "*ElectroniK* Inductance Bridge Receivers."

MINNEAPOLIS **Honeywell**
BROWN INSTRUMENTS
First in Controls



Steel arches "give" to make mining safer

The secret of safety in this ore drift lies in the Bethlehem Yieldable Arch sets which "give" instead of deforming under excessive load. The yielding feature is formed by over-lapping two adjoining nestable segments and fastening them together with heavy U-bolt clamps.

The tightness of the clamps controls the sliding action of the arch. Properly adjusted, the joints hold fast under normal loads. But when unusually heavy pressures begin to bear down, the joints yield before deformation of the steel can occur, permitting natural subsidence of the surrounding strata and redistribution of the load. The structural integrity of the arch is maintained and safety underground preserved.

There's real economy in these arches, too! First of all, thanks to their yieldability, they far outlive conventional timber supports and for this reason alone often pay for themselves within a year. And, on top of that, they are usually recoverable for re-installation elsewhere.

The Yieldable Arch is easy enough to install; no special tools or fancy equipment is needed. Your own men can set them up and take them down with only a minimum of technical supervision. Pictured above is the standard arch; you can also get Yieldable Rings or special shapes and sizes to meet your individual needs. One of our engineers will gladly give you full details.

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BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

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Core DRILL HOLE Specialist

This Sprague & Henwood 40-C low mount Core Drilling Machine, within its rated capacity, is the first choice of leading mining companies, contractors and drillers everywhere. Every one of these users wants a highly efficient drill, and this is it . . . built to operate under the most difficult conditions. It is almost impossible to tip the machine because of the design of the skid frame and its extremely low center of gravity.

Sprague & Henwood manufactures other sizes and types of diamond drilling machines and will have the machine you need. They also manufacture a complete line of core drill accessory equipment including diamond bits and reaming shells. Write today, giving full particulars of your needs. Detailed information and recommendations will be forwarded to you immediately, without cost.

CONTRACT DRILLING SERVICE

Sprague & Henwood is the leading contract drilling firm in the United States, and crews are available for work throughout the country. Inquiries for all types of contract drilling work will receive prompt attention, and estimates submitted promptly.

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WASHINGTON

Gladstone Mountain Mining Co. has mined approximately $65,000 worth of high grade lead ore from a new ore chimney discovered at the old Gladstone Mine in northeastern Washington. R. H. Graham, president, said about 300 tons of ore have been taken from an open pit and 50 tons have been trucked to the Bunker Hill smelter at Kellogg, Idaho.

"The discovery is even better than first indicated," he said. "Boulders weighing up to 9 tons, containing about 75% lead, are being pulled out of the pit with a chain winch."

He said the lessee, A. G. Lotze of Northport, plans to sink a shaft in the chimney when the pit gets too deep for the present operation.

A three-year contract with the American Smelting & Refining Co. has been approved by the Tacoma Smelter Workers Union for the company's smelter near Tacoma.

It calls for a wage increase of 10c an hour this year and additional increases of 7c each during the next two years, plus an increase of 2c an hour in health and welfare benefits. Pensions and holiday pay also are increased and nine pay scales are reclassified upward. The entire "package" will amount to 36c an hour in the third year of the contract, said William E. Lee, union business agent.

The local is an affiliate of the International Union of Mine, Mill & Smelter Workers.

WYOMING

Lost Creek Oil and Uranium Co., Rawlins, has announced ground will be broken early in July for a $3-million uranium processing mill in the Crooks Gap area of Fremont County.

President Bob Adams said he expects AEC permission in mid-July to build the mill. He said AEC has requested that ore shipments from Lost Creek to the buying station at Riverton be discontinued.

Lucky Mc Uranium Corp. has filed 80 millsite claims with the Fremont County Clerk's office for a proposed uranium processing mill.

The 400 acres are located just north of Lucky Mc's open pit uranium mine in the booming Gas Hills area.

Lucky Mc and Utah Construction Co. have applied to the Atomic Energy Commission for authority to construct a $5-million, 750-tpd capacity mill.

Lisbon Uranium Corp. has concluded a joint operating agreement on development of 41 unpatented mining claims owned by the Fuesner Brothers of Basin, located on Little Mountain, Big Horn Range.

A. P. Kibbe, Salt Lake City, said the operating contract calls for sharing of any net profits from the operations. Roy H. Wayne and Roy D. Fuesner have in past sent a selected shipment of 175 tons

Allis-Chalmers Pumps Solve a Quarrying Problem

Jetting Silica calls for Constant High Pressure

And, for 10 years, Allis-Chalmers pumps at Ottawa Silica Company, Ottawa, Illinois, have been delivering the pressure needed to disintegrate sandstone and carry the resulting silica to hydraulic intake lines.

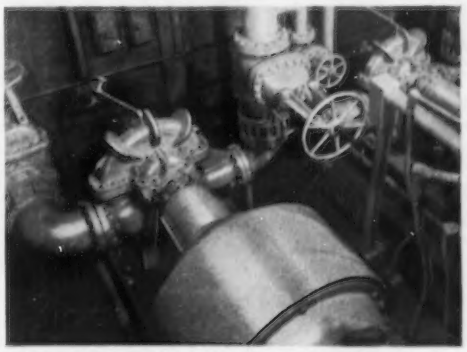
To meet a wide range of capacities, three double volute pumps are used. They insure freedom from shaft deflection under light loads. These pumps are rated at 3000 gpm against a 450-ft head, delivering nozzle pressures as high as 180 psi.

Ottawa Silica Company also selected Allis-Chalmers pumps for boiler feed, condenser auxiliary, process water, fine sand reclamation and pit-seepage water level control. Other Allis-Chalmers equipment at the Ottawa plant includes turbines, vibrating screens, motors and controls.

You Get MORE than a Pump . . . When You Specify Allis-Chalmers

You get the advantage of Allis-Chalmers wide experience in supplying pumps to all industries. You are assured of modern design, heavy duty construction and correct application aid—resulting in added years of dependable day-after-day pump service.

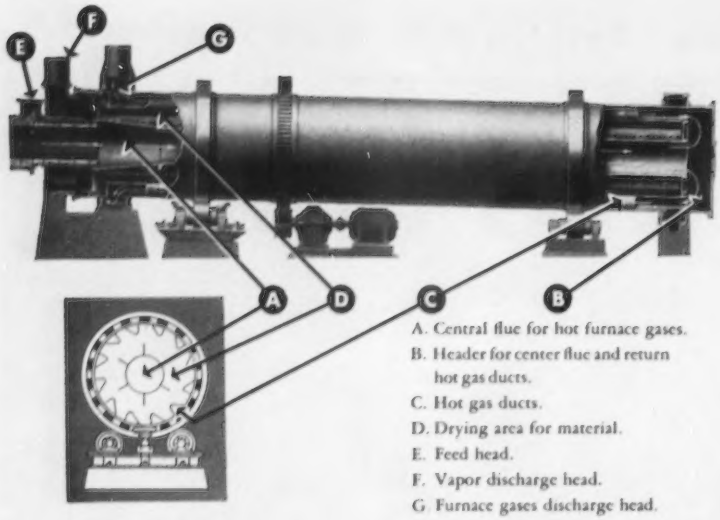
Allis-Chalmers is the only company that can offer you "One-Source" responsibility for a complete unit — pump, motor and control — all built to work together. For "MORE" information, call your local A-C office or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.



Three of these Allis-Chalmers pumps furnish the water used in the jetting process at Ottawa Silica Company. They are powered by Allis-Chalmers synchronous motors rated at 500 hp, 2300 volts, 1800 rpm.

A-C ALLIS-CHALMERS

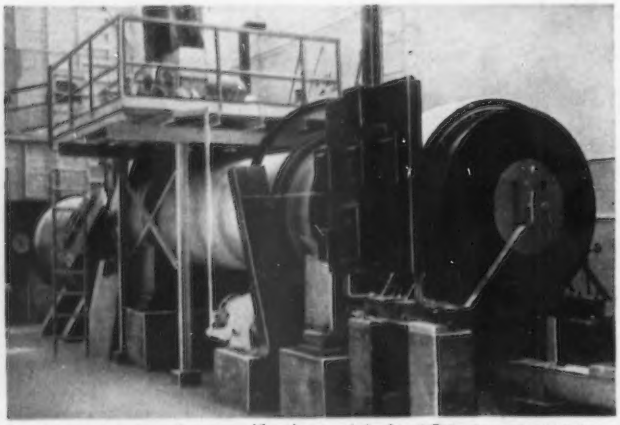
A-5117



A. Central flue for hot furnace gases.
B. Header for center flue and return hot gas ducts.
C. Hot gas ducts.
D. Drying area for material.
E. Feed head.
F. Vapor discharge head.
G. Furnace gases discharge head.

Ruggles-Coles INDIRECT-FIRED DRYERS and HEATERS

- Dry without contamination from combustion gases, regardless of fuel.
- Minimize auxiliary dust collection when handling fine precipitates and filter cake.
- Heat pulverized materials for process work.
- Collect vapors at high concentration.
- Available fabricated with heat and corrosion-resistant metals.



Ruggles-Coles Indirect Heat Dryer handling 200 mesh talc.

Write for complete specifications. Ask for Bulletin AH-438-1

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Wyoming *(Continued)*

of uranium ore from the properties to Riverton buying station.

This selected shipment averaged 1.43% U_3O_8, Kibbe said.

Continental Uranium, Inc. has purchased Crooks Gap Mine in Fremont County from the Gaddis Mining Co. Announcement of the purchase was made by Gerald Gidwitz, chairman of the board, who said the exact price would be determined following verification of the mine's uranium ore potential by Continental.

Thus far only about 30% of the Crooks Gap property has been explored. Out of 85 holes drilled to date, 86% have encountered uranium mineralization of 0.10% or better. Thus far six separate ore zones at depths of from 30 to 230 ft have been found. Some assays have run as high as 28.32% U_3O_8 and the average assay is reported about 0.30%.

IN CANADA

ONTARIO

A letter of intent covering purchase of $24,192,000 worth of uranium precipitates has been received by Cavendish Uranium & Mining Co., from Eldorado Mining & Refining Ltd., the Canadian Government's official purchasing agent of uranium products. A treatment plant with capacity of 750-tpd is planned on the 53-claim property in the Haliburton-Bancroft area. Original estimates based on surface diamond drilling suggested 2,038,181 tons grading 0.08% uranium oxide but subsequent underground development showed greater widths and better grade.

Diamond drilling on the 18-claim property of International Lithium Mining Corp. 90 miles southeast of Fort Frances, has indicated 1.5-million tons averaging 1.2% lithium oxide to depth of 500 ft. Two diamond drills are in operation and deeper drilling to test structure at depth is planned.

Faraday Uranium Mines has provided for expansion of the 750-ton concentrator being built on its Bancroft area uranium property to 1,000 tpd. Contract is held with Eldorado Mining & Refining Ltd. for purchase of $29,754,800 worth of uranium concentrates. Underground work in preparation for production is progressing on schedule.

Stanleigh Uranium Mining Corp. is planning to bring its Blind River area property into production at a rate of 3,000 tpd. Diamond drilling has indicated 12,058,600 tons grading 0.093% uranium oxide, of which 6,912,900 tons averages considerably better than 0.1%. Further drilling is expected to add tonnage. Two shafts are being put down to about 3500 ft.

Can-Met Explorations has received a

World's Largest Shovel is the Mountaineer, built by Marion Power Shovel Co. for Hanna Coal Co. It is 16 stories high, and scoops up overburden in 90-ton bites. USS "T-1" steel is specified for such major components as the bucket, dipper stick and crowd rack; to assure the strength, toughness and ruggedness that adds up to long service life.

"T-1"...a super-tough nickel alloyed steel prevents breakage...slashes downtime

At 38°F below zero...or at 900°F above..."T-1" steel stays *super-tough!*

Downtime troubles *go out* when "T-1" steel *goes in* dipper sticks, shovel buckets, car bottoms, bulldozers and other mining equipment.

That happens because "T-1" steel is a constructional alloy steel combining exceptionally high levels of strength and toughness. It stands up under heavy shock loads. Curbs breakage the year 'round.

Note its advantages:

90,000 psi minimum yield strength.

Readily weldable . . . needs no preheat nor stress relief.

Resists impact at sub-zero temperatures.

Four times as resistant as carbon steel to atmospheric corrosion.

Use "T-1" steel for heavily stressed parts. Watch them stay on the job, earning profits. Why take chances with steel of lower yield strength and consequent risk of failure in service? Idle men and machines make it a costly proposition...so, put "T-1" steel to work now.

For details on USS "T-1" steel, write to United States Steel Corp., Pittsburgh 30, Pa.

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...quicklime and hydrate
West End, supplier of quality chemicals for over 31 years, proudly announces expansion of its hydrate and quicklime production. Discovery of an extensive deposit of high grade limerock resulted in the construction of a large new processing plant. The photo shown here is of the giant 340 foot rotary kiln. The plant will soon be producing increased quantities of highest quality lime to serve the needs of growing western industry. We suggest you give consideration to West End as a primary source of supply. Inquiries and your specifications are invited.
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HARDHED matrix for non-abrasive formations
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Ontario *(Continued)*

formal contract for $75,852,000 from Eldorado Mining & Refining Ltd., covering purchase of uranium precipitate production at a premium price. This is the fourth contract completed with companies located in the Blind River area. Sinking of two shafts is currently under way with plans for treatment plant of 2500-tpd capacity. Property is located in the Quirke Lake section of the camp.

Three potential uranium producing companies, Lake Nordic Uranium Mines, Panel Consolidated Uranium Mines and Spanish American Mines, all operating in the Blind River area, merged into one organization, Northspan Uranium Mines. The combined proposed milling rate of the three companies is 9,000 tpd. Six shafts are being sunk on the properties. Indicated ore reserves on all three reportedly total over 17-million tons.

Temagami Mining Co. is shipping high grade copper ore to Noranda smelter from its open pit operation on Temagami Island. Shipments are expected to average about 700 tons weekly during the spring-fall shipping period. In the meantime, exploration work is being continued and it is anticipated that additional tonnages of high grade ore will be developed.

Dominion Gulf Co. has reportedly discovered a major size columbium deposit at Trout Lake, 17 miles northeast of Chapleau. Two drills are on the property and over 16,000 ft of diamond drilling has been completed. Several deposits have been indicated. One of these, the D zone, has been cut in four holes along a length of 600 ft for an average of 0.536% columbium pentoxide over core width of 370 ft. A second zone, the B, has been tested in six holes along a length of 1500 ft with intersections averaging 0.43% over 101-ft core length.

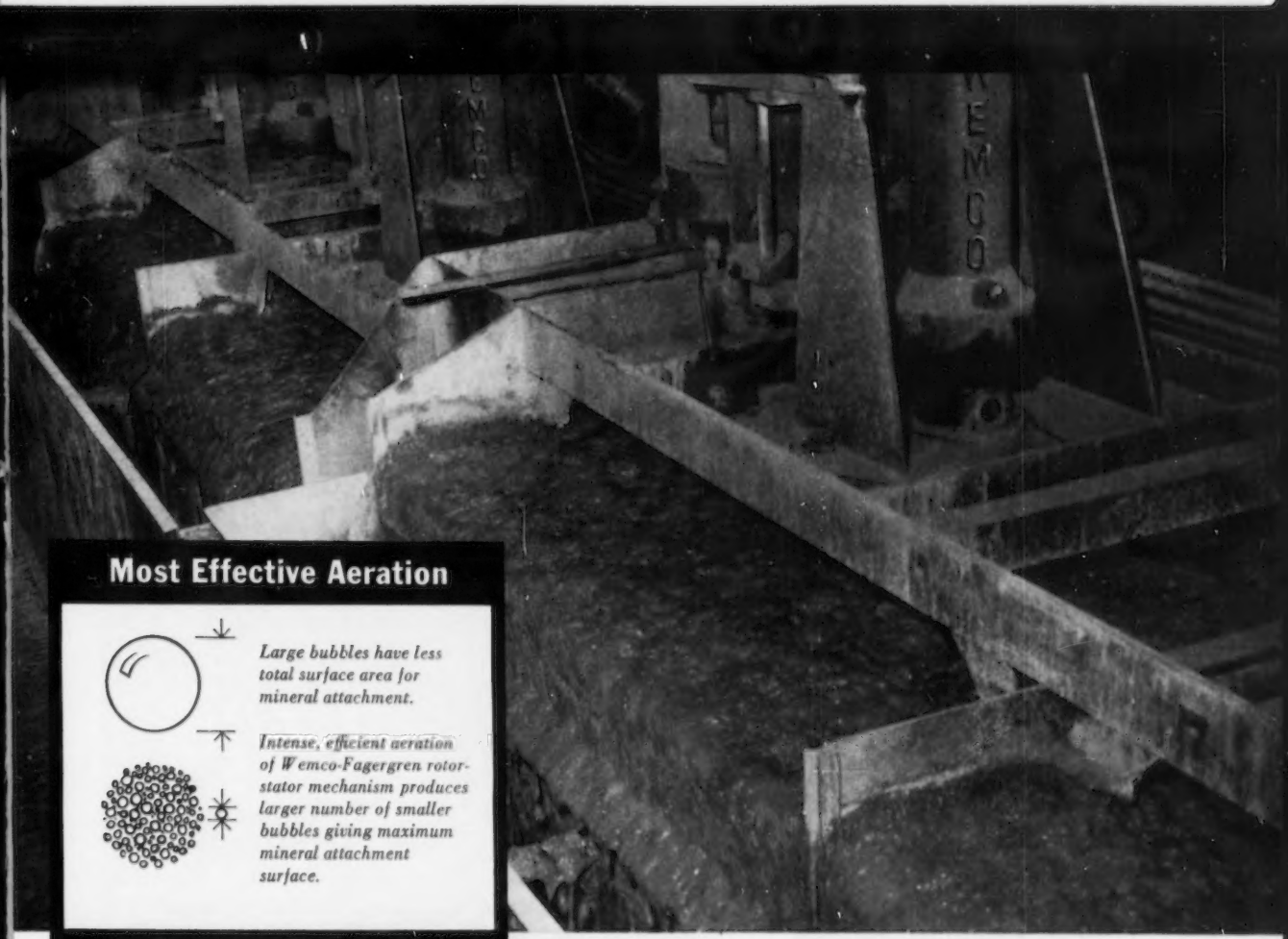
McFinley Red Lake Gold Mines has started shaft sinking at its gold property in the Red Lake area. A standard 3-compartment shaft is being put down to a depth of 400 ft with lateral work to be carried out on three or four levels. In previous work some 47,000 ft of exploratory diamond drilling returned a number of gold intersections along a total length of about 3900 ft.

Diamond drilling commenced in early July on the Hotham and Frechette Islands mining property of Poly Ores Mining Co. Ltd. under the direction of Hopkins Exploration Consultants.

The drilling is designed to test electromagnetic conductor anomalies and known zones containing copper, gold, silver and tungsten. Surface sampling is being carried out.

QUEBEC

Milling of ore from Lyndhurst Mining Co.'s copper mine in Destor Twp, some 30 miles north of Noranda, was started at the Beattie-Duquesne mill early in



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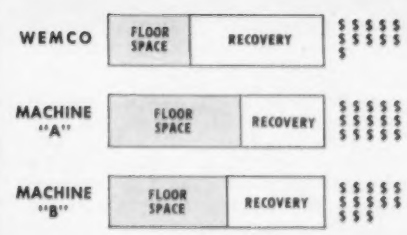
Large bubbles have less total surface area for mineral attachment.

Intense, efficient aeration of Wemco-Fagergren rotor-stator mechanism produces larger number of smaller bubbles giving maximum mineral attachment surface.

Greatest Recovery per Dollar



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"... One goal of the test was *recovery*, without sacrifice in grade, and the *Wemco Fagergrens consistently led in this factor.*

"... as the test progressed there was a trend to increase tonnages of feed per machine. As these tonnages were increased, operating horse-power increased on all machines *except the Wemco Fagergrens.*

"... mechanical and design changes were made on several occasions in (two of the competitive) units. During the testing program *there were no mechanical revisions or design changes on the Wemco Fagergrens.*"

- And as final proof of their superiority, Wemco Fagergrens also excelled on such important counts as *simplicity of operation . . . least total number of mechanisms required . . . longer effective life of wearing parts.*

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Quebec *(Continued)*

July. Initial rate was 300 tpd and this is to be stepped up to the 500-ton objective as soon as possible. Ore shipments were started early June.

Moburn Copper Ltd., formed to take over the 20-claim base metal property of Ria Canadian Exploration in the Clericy area, 10 miles northeast of Noranda, is carrying on deep diamond drilling and metallurgical testing. Based on drilling results a total of 3,037,000 tons has been estimated with average grade of 0.69% copper, 2.18% zinc, 0.052 oz gold and 0.62 oz silver per ton. Sulphur content averages 37.4%. Of this tonnage an estimated 447,500 tons averages 1.42% copper, 1.75% zinc, 0.054 oz gold and 0.82 oz silver with sulphur content of 34.26%.

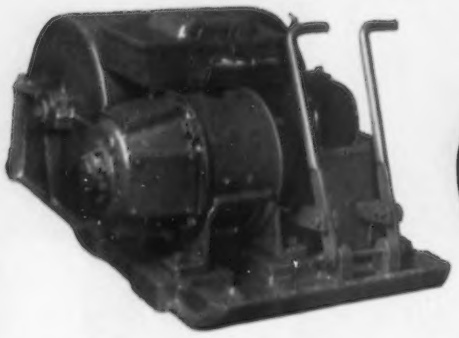
New Jaculet Mines is carrying out a concentrated diamond drilling program at its copper prospect in the Chibougamau area. Fifteen drill rigs are in operation to determine quickly the best location for a production shaft. Two copper zones have been indicated, of which the No. 1, or main, zone has been traced along a length of 2,000 ft.

Mill construction is expected to start late this year at the nickel-copper property of Eastern Metals Corp. in the Eastern Townships. An initial milling rate of 500 tpd is planned. The vertical shaft has been deepened to 1,153 ft to provide three new levels or eight levels in all. Above the fifth level reserves are calculated at 510,480 tons of nickel ore grading 0.82% nickel and 472,050 tons of copper ore grading 1.46% copper and 0.15% nickel.

Shaft deepening program to provide four additional levels to 850-ft depth at the copper property of Duvan Copper Mines in Desmeloizes Twp, 8 miles southwest of Normetal, has been started. Deep diamond drilling is also under way. Shipments of ore stockpiled from development work are being made to the Noranda smelter.

Quebec Lithium Corp. has installed additional equipment at its lithium-producing mine in the LaCorne area to raise mill rate from 500 to 1,000 tpd. Grade of lithium ore milled to date has been averaging about 10% higher than previously indicated by diamond drilling. Company is also negotiating for sale of feldspar. At the new mill rate it is expected that about 400 tons of feldspar could be produced daily.

Headquarters for "BROWNIE" proved mine hoists



IN MINING OF ALL TYPES, there is no haulage hoist problem than cannot be handled by a "BROWNIE". Hoist with a reputation of long standing for dependable service and the ability to take the punching of constant haulage. Let us discuss your problems with you for greater efficiency and more effective service. **Sanford-Day Iron Works, Inc., P. O. Box 1511 . . . Telephone 3-4191, Knoxville, Tenn.**

Among our various types and models available are hoists with rated capacities from 2,000 to 24,000 lbs. rope pull and with speeds from 25 to 300 feet per minute.

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"SUPER MARKET FOR MINE CARS" — *all types* * PRECISION WHEELS * "BROWNIE" HOISTS, CAR RETARDERS, SPOTTERS, PUMPS AND OIL SPRAY SYSTEMS * GISMO SELF-LOADING TRANSPORT that loads *(mucks)* in development or production . . . transports . . . supports 2 to 5 jib mounted drills . . . back fills . . . moves boulder rocks . . . makes its own roadways and cleans up completely — a new method of hard rock mining offering a tremendous reduction in cost per ton!

NEW BRUNSWICK

Erection of a pilot plant on its 41-claim manganese prospect, 8 miles west of Bathurst, is being considered by Canadian Manganese Mining Corp. In excess of 30-million tons of manganiferous shales grading 5.5% manganese reportedly were indicated in surface work carried out in 1953 and 1954. Subsequent metallurgical tests disclosed that a marketable concentrate could be made. Mining operations would be by open pit.

Heath Steele Mines is well ahead of schedule in preparing its large base metal property in the Newcastle area for production. Work on the 1,500-ton plant is progressing favorably. Four orebodies are being prepared, two from underground and two from surface open cuts. Production is scheduled for next summer. Heath Steele is a subsidiary of American Metal Co. and International Nickel holds a 25% interest.

Billiton Co., prominent Dutch mining and smelting organization, is meeting with considerable success in exploration of its optioned base metal property, located some 12 miles northwest of Bathurst. Three ore sections have been outlined along a length of 3400 ft with widths of from 4 to 6 ft. A 500-ft, 3-compartment shaft is to be sunk on the central zone, where diamond drilling on the 200-ft horizon established a length of 1,000 ft over true width of 4.8 ft grading 3.15% lead, 3.27% zinc and 3.9 oz silver.

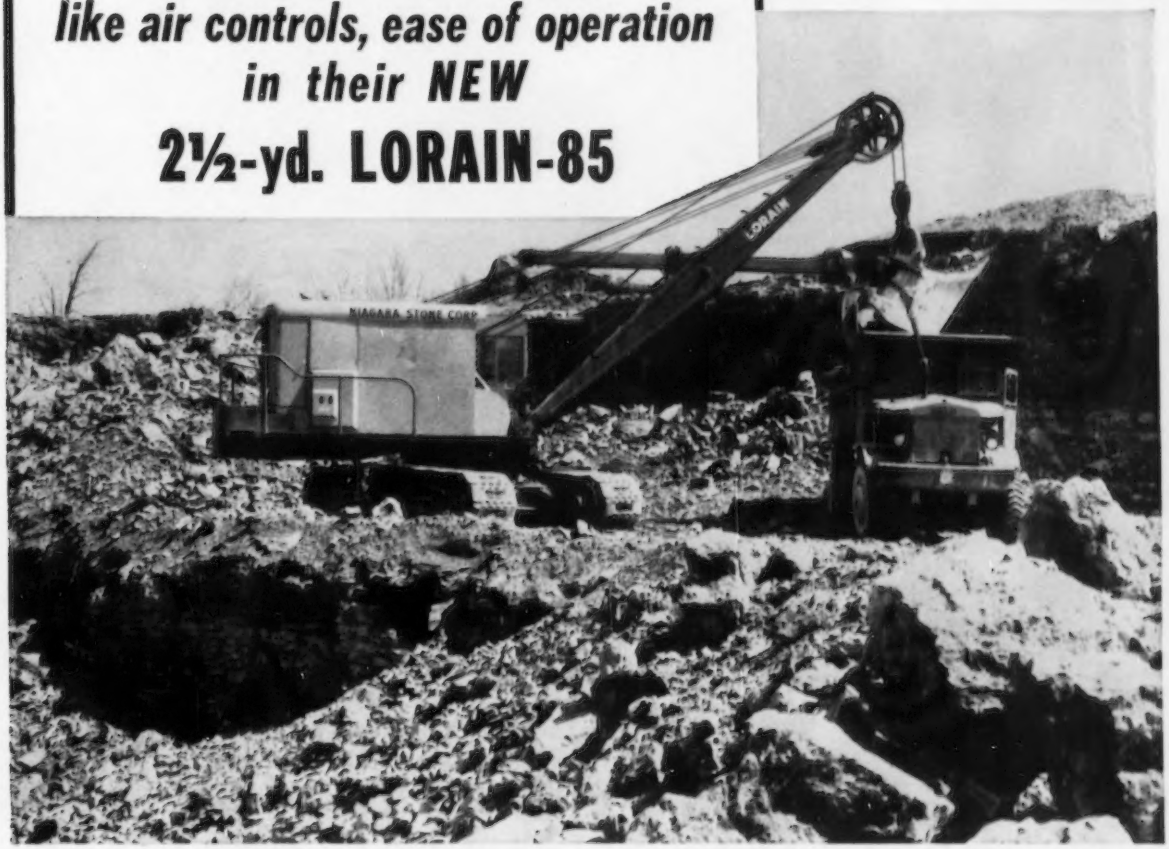
NEWFOUNDLAND

Advocate Mines has made a major as-

Niagara Stone Corp.

like air controls, ease of operation in their NEW

2½-yd. LORAIN-85



Proof that Niagara Stone Corp. of Niagara Falls, New York, like Lorains is the fact that they have just purchased a new 2½-yd. Lorain-85 Shovel. A previous 1¾-yd. Lorain-80 Shovel served them long and well—digging many hundreds of thousands of yards of tough dolomite limestone. When Niagara Stone Corp. again was in the market for a new shovel, Lorain was their choice for the second time.

Niagara's new 2½-yd. Lorain-85 is shown in the photo. It is quarrying shot rock against a 20-ft. face at their limestone quarry. The Lorain loads 15-ton trucks in 3 minutes each for hauling to the rock crusher and works a steady 9 hours a day. An average of 250 tons per hour is loaded out by the Lorain.

Niagara Stone Corp. report they are well pleased with the new Lorain-85, particularly the new "Metered-Air" controls. They report these controls add greatly to ease of operation in the 2½-yd. shovel.

There are many other modern features in Lorain-85's that contribute to operating efficiency and big production. The 3-shaft turntable design permits simultaneous hoist, swing and travel. The double center drive power transmission applies maximum engine power to all operations. A torque converter power take-off is available for the most productive digging results. The new "Metered-Air" power is applied to easily operate hoist, crowd, retract, travel, boom derricking and lowering clutches. In addition, the big "85" is equipped with a new, huskier 26-ft. shovel boom for greater digging ranges. You will find the Lorain-85 Shovel a real, heavy-duty money-maker for the most demanding digging duty.

See your Thew-Lorain Distributor for facts about the 2½-yd. Lorain-85 . . . get the story about the new "Metered-Air" controls and the many other features that you will want in your next shovel!

THE THEW SHOVEL CO., LORAIN, OHIO

THEW LORAIN

Hammer Life Increased 7 Times by HARD-FACING

Hammers used to crush limestone and shale remain in operation for 70 weeks now that they are protected with HASCROME high-chromium rod. Unprotected hammers are completely unserviceable after operating for only 10 weeks under the same conditions. The usual maintenance procedure is to recondition the hammers with HASCROME rod about every two weeks—after they have crushed approximately 13,000 tons.

Hard-facing proved to be the economical solution to this typical problem of severe impact and wear. Periodic rebuilding with inexpensive HASCROME iron-base rod resulted in one hammer doing the work of seven, thus saving the cost of six new hammers.

HASCROME rod is widely used to protect rock crushing and earth moving equipment because of its resistance to severe shock and impact. It is a tough alloy which work-hardens to Rockwell C-50, and doesn't chip or spall under heavy impact. The ability to resist mushrooming makes HASCROME rod an excellent build-up rod, too. It provides an excellent shock-proof base for harder, more corrosion-resistant HAYNES hard-facing alloys when severe abrasion or corrosion is the major problem.

See your local dealer for more information on the complete line of 18 HAYNES hard-facing alloys. One of them will solve your wear problem. If you don't know the location of your dealer, write to Haynes Stellite Company, a Division of Union Carbide and Carbon Corporation, Kokomo, Indiana.

See... | Your local Haynes Stellite Dealer

or

Write... | to Haynes Stellite Company

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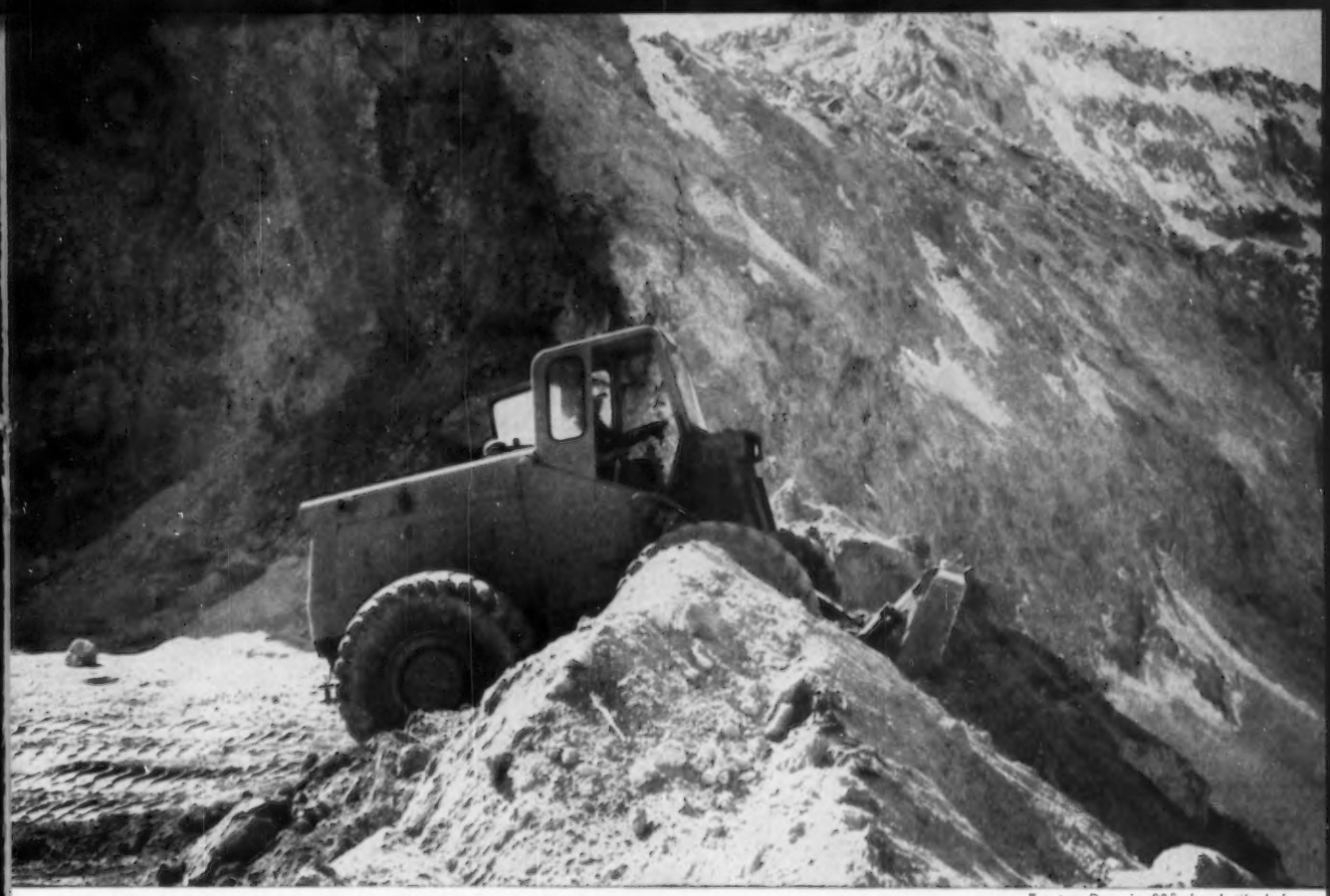

Tractor Dozer's 33° bowl tilt helps speed ledge cleanup at Consolidated Copper's open pit near Ely, Nevada.

Before you buy <u>any</u> dozer...

Check Michigan Tractor Dozer's 27 mph speed, power-tilting bowl, full-time four-wheel traction

If you're in the market for any kind of dozer, be sure to check the new MICHIGAN Tractor Dozer before you buy. This job-proved unit dozes 2¾ cubic yards per pass. Its turbo-charged diesel engine develops 165 hp, with maximum rimpull of 28,000 lbs.—plenty for heavy-dozing, land-clearing, or push-loading. At 27 mph, it runs rings around any dozer on the market!

Full traction while turning. All four wheels of the Tractor Dozer are *always* driving, except when you declutch rear axle for highway travel. Rear-wheel steer eliminates unnecessary tire wear—you don't brake or drag inside wheels on turns. If one wheel begins to slip, a locking differential automatically applies power to wheel with firmest footing.

High flotation tires, oscillating axle. Big low pressure tires give the Tractor Dozer excellent ground contact in wet, dry, or sandy footing. You can cross railroad tracks or travel along ties or road bed; you can climb curbs and drive safely on any kind of road surface. On uneven terrain, the steering-wheel axle oscillates to keep both rear wheels in firm contact with the ground. With 14½ inches of ground clearance, it's practically impossible to get "hung up."

Power-shifting, 300% torque multiplication. Clark's power-shift transmission eliminates the conventional engine clutch and foot pedal—the most notorious cause of excessive maintenance and operator fatigue. With two fingertip levers on the steering column, operator can instantly shift between High-Low and Forward-Reverse—even when moving in either direction.

The 3-to-1 Clark torque converter gives a steady power flow, regardless of speed. As load gets heavier, torque output automatically increases up to 300% at stall speed—gives the extra torque to plow through the roughest spots. You can't stall the engine, and there's no clutch to slip.

Power-tilting bowl. Powerful double-acting hydraulic cylinder tilts bowl back and forth through 33 degree arc. You can change angle of bowl from "dig" to "float" as you work . . . move cutting edge back and forth to uproot stumps and boulders. Two 6-inch lift cylinders give tremendous lifting power and down-pressure—cutting edge raises from 24¼ inches below ground level to 43¾ inches above.

See Tractor Dozer in action—on your job. Write us to arrange a demonstration. You pick the work . . . then time cycles, measure output, compare price per yard of dozing capacity (don't forget MICHIGAN's f.o.b. price includes power-shift transmission, torque converter, planetary-wheel axles, and power-tilt blade . . . you don't have to pay for "extras" to get top efficiency). Or, if you'd like more details, before taking the time to watch a demonstration, ask us to show you a 20-minute color movie of the Tractor Dozer. No obligation, of course.

CLARK EQUIPMENT COMPANY
Construction Machinery Division
2465 Pipestone Road
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CLARK® EQUIPMENT

Newfoundland *(Continued)*

bestos discovery on its 1,575-sq mile concession on Burlington Peninsula on the north coast of the island. Drilling on the main west showing has indicated an estimated 65,000 tons per vertical ft, while additional tonnage has been indicated in other areas to the east, south and north.

BRITISH COLUMBIA

Contracts have been signed in Tokyo for the delivery of 1,380,000 tons of Quatsino iron ore, on Vancouver Island. Empire Development Co. Ltd., a company formed by Quatsino Copper Gold Mines Ltd. and Mannix Ltd., will make delivery over a period of three years.

Contracts are worth between $10-million and $12-million and spokesmen say it is the largest contract yet placed by Japan in the dollar area at one time.

It will enable extensive ore deposits near Kathleen Lake, near the northern tip of the island to be put into operation.

Yawata Iron & Steel Co. Ltd., will take 511,000 tons; Juji Iron & Steel Co. Ltd. 397,000 tons; Nippon Kokan Kabushiki Kaisha 216,000 tons; Sumitomo Metal Industries Ltd. 54,000 tons; Kawasaki Steel Corp. 104,000 tons; Nakayama Steel Works Ltd. 61,000 tons; Amagasaki Iron & Steel Co. Ltd. 37,000 tons.

Quatsino and Mannix formed the new Empire Development Co. Ltd. for the purpose of developing the iron ore properties on Vancouver Island owned by Quatsino.

Giant Mascot Mines Ltd. operating a lead mine at Spillimacheen, has paid $100,000 for the Rothschild claim which lies a few hundred feet east of their main ore zone.

Claim is the only one in the area in favorable ore-bearing geology not previously held by the company. Diamond drilling from the surface is under way to test the ore potential under known outcrops of barite mineralized with lead.

At Lead Mountain, 5 miles from the main Giant Mascot property, diamond drilling is under way. This is a joint effort with Consolidated Mining & Smelting Co. of Canada Ltd.

Cariboo Gold Quartz Mining Co. Ltd, reports acquisition of nine claims known as "the French" mine from Kelowna Mines Ltd. Property is near Hedley.

President Dr. W. B. Burnett told directors: "We feel we are most fortunate in obtaining such a desirable property and look on the association with the former owners as most valuable. We have every confidence that the property will very quickly become a substantial contributor to our cash account."

Noranda Exploration Co. Ltd. has staked more than 200 claims in the Brenda Lake region, 25 miles west of Peachland. Two camps have been set up and diamond drilling is planned. Company is an offshoot of Noranda Mines of Toronto.

Granby Consolidated Mining, Smelting & Power Co. reports drilling underway at both the Phoenix and Copper Island properties in an attempt to prove up sufficient ore for production operations. More than 500 tons have been proven at the Phoenix operation and large tonnage of low grade copper ore is indicated at Copper Island.

Company reports plans to bring up production at its Copper Mountain mine from the present 5,000 tpd to 6,000.

Granby also has taken options on claims following discoveries of nickel near Williams Lake (180 miles north of Vancouver).

NOVA SCOTIA

Mineral Exploration Corp. says it is planning to proceed with the construction of a large smelter with a capacity of 150 tpd zinc on either the Sydney or Canso Strait locations on Cape Breton Island. This would be eastern Canada's first zinc smelter and would permit the company to put into production the 2.7-million-ton zinc deposit indicated on its large concession on Cape Breton. Grade is estimated by the firm at 2.5% zinc with cadmium and germanium values. Another structure in which an additional 720,000 tons has been indicated to shallow depth, is also being investigated.

Can you identify these areas?

The photos below were taken by Fairchild aerial photo crews during routine survey flights.

More than material for a guessing game, they demonstrate the various services provided by Fairchild: magnetometer surveys for the geologists; detailed photomaps for the city planner; and topographic maps for the civil engineer. All of them have learned that when aerial surveys are needed fast, and must be right the first time, they can depend on Fairchild.

1.

2.

3.

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1. Rangely Anticline, Rangely, Colorado
2. Jetty construction, Jones Inlet, Long Island, N. Y.
3. Death Valley, California
4. Los Angeles Harbor, Los Angeles, California

The next time you consider a survey job, get the Fairchild story. Often, aerial surveys can save 50%, or more, in time and money.

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Tumbling terrain buried more than 500 feet of 5-year-old Anaconda 3/0 Awg SH-D Shovel Cable. Despite accident, cable continued to supply power without interruption to giant shovel.

...and the wall came tumbling down

When this 90-foot wall came down unexpectedly, a five-year-old length of Anaconda 3/0 SH-D Shovel Cable was buried under thousands of tons of jagged rock.

Yet – *after ten days* – the cable and shovel it supplied continued to operate! Later, the cable was relocated–and is still giving service.

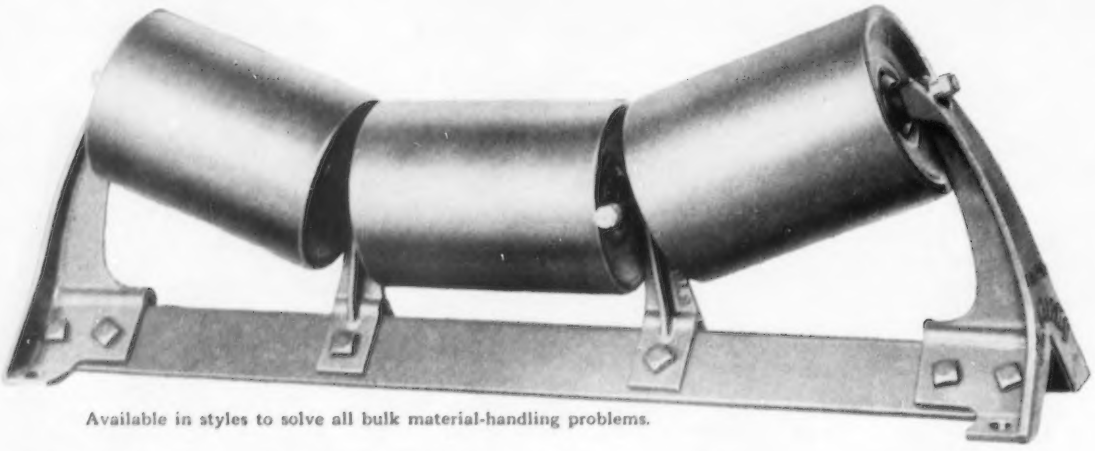
NEW BUTYL INSULATION

Longer life, better performing cable is the result of advanced engineering and manufacturing know-how that go into all Anaconda mine cables. Securityflex* Type SH-D Shovel Cable, for instance, is made with high-grade butyl insulation that withstands ozone, heat and moisture. Neoprene jacket is extremely tough and abrasion-resistant. Patented rubber cores cushion the ground wires and help prevent breaks.

Safety and economy of Anaconda cables have been proven in mines all over the world. The *Man from Anaconda* will be glad to help you on any cable problem. For cable, see your Anaconda distributor. And for copy of booklet, "*. . . and the wall came tumbling down,*" write: Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

*Reg. U. S. Pat. Off. 5032-A

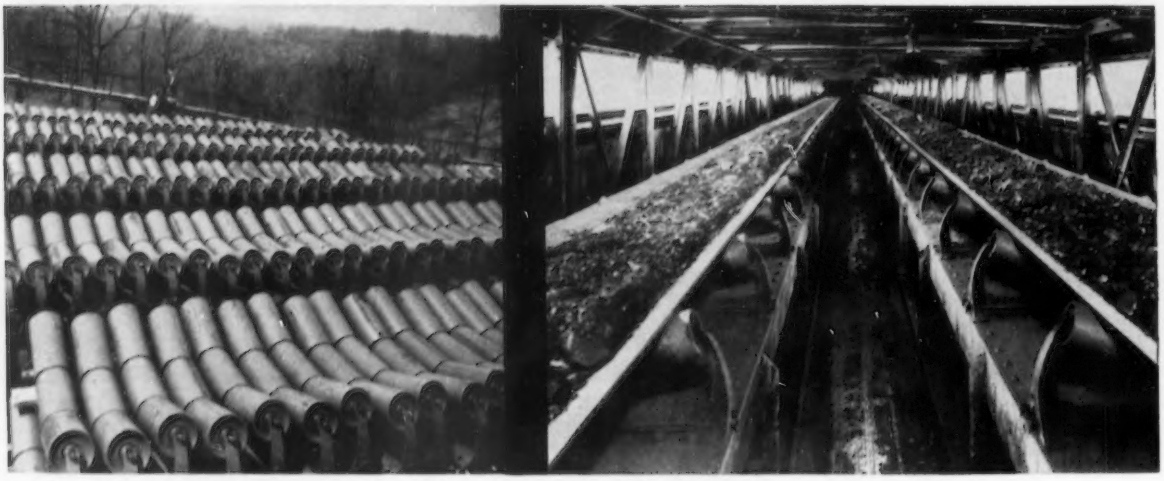
ask your distributor for ANACONDA® MINE CABLE



Available in styles to solve all bulk material-handling problems.

for heavy handling under adverse conditions

JEFFREY RELIANCE BELT IDLERS



Jeffrey idlers awaiting installation on a cross-country coal conveyor from mine to power plant . . . and at work on a heavy hauling job.

Jeffrey idlers offer every feature essential to belt protection, dependability and long service. Equipped with roller bearings, these Reliance idlers assure maximum efficiency and economy of conveyor belt operation.

The outer shell of the rolls is made of high-quality steel tubing, into which the ends are carefully centered and welded, forming a one-piece balanced roll. Corners are rounded to prevent injury to the belt. The sturdy, malleable-iron stands are die straightened to assure proper alignment and snugness of fit.

All parts of the Jeffrey Reliance idler are interchangeable. Idlers and parts are always available, ready for shipment from factory or distributor stock. The Jeffrey Manufacturing Co., Columbus 16, Ohio.

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MANITOBA

Green Bay Mining & Exploration reports a substantial tonnage of spodumene has been outlined on its Herb Lake lithium property. Mill plans are now being considered for a 1,000-ton capacity unit. Company is also carrying out exploration work on a large group of claims in the Snow Lake area.

Montgary Explorations shaft sinking is scheduled to start this summer on its Bernic Lake lithium property.

Firm is negotiating for a power line to the shaft site. An electric hoist capable of 1,000 tpd has been ordered. A tractor road to the property is now being converted to an all weather road.

Ore reserves are estimated at 5.5-million tons averaging 1.77% lithium oxide.

Hudson Bay Mining & Smelting plans to build an 8-mile road and power line from Snow Lake to the recently discovered orebody at Chisel Lake. Substantial tonnage now warrants underground development. Exploration work will continue on the Millar Lake orebody, 4 miles southeast of Snow Lake.

Copper-Man Mines reports diamond drilling operations have been suspended on its Herb Lake property. Over 15,000 ft of drilling was carried out but only scattered values were obtained in the deeper drilling of the mineralized zone. The main zone is estimated to contain 115,000 tons averaging 3.1% copper and 5.1% zinc.

Allcop Mines reports a new copper find in the Oxford Lake area of northern Manitoba. Main showing is on Hyers Island where an X-ray drill hole cut copper mineralization assaying 11.9% copper over 12 ft. A geophysical survey is now underway to be followed by diamond drilling. Three separate claim groups have been acquired by the company.

IN LATIN AMERICA

BRAZIL

What started as a coincidence—two U. S. mining research teams in the same territory in Brazil at the same time—developed into an anti U. S. propaganda drive that has been tagged as Communist-inspired.

One of the teams, a mixed-commission geodetic survey with Brazilian and U. S. engineers, was inspecting a radioactive area in Maranhão. Shortly after the arrival of the geodetic team (equipped with a helicopter and two light planes) another U. S. bunch arrived. The latter was looking for titanium-bearing earth.

The director of the port at the spot in Maranhão called for an enquiry to look into the question: "Why so many U. S. planes and prospectors?" The query was put in the papers and the country was off on another spree of nationalism. For years, oil has been Brazil's pet nationalistic protection piece, especially against "U. S. oil trusts." Now it's monazite sands and radioactive earths, which "must be protected from U. S. mining trusts."

Some mining engineers in Rio are definitely worried. They say the "climate for future U. S. mining ventures in Brazil looks very cloudy." At present, there are two big U. S. mining organizations working in Brazil, Bethlehem Steel and U. S. Steel (both are mining manganese). Another firm, M. A. Hanna Co., is prospecting for non-ferrous metals. Kaiser and Reynolds Aluminum companies are both interested in working bauxite deposits. Another group is looking into the possibility of mining iron ore in Minas Gerais.

During the last few months, Mineração Assu, a U. S.-Belgian-Brazilian mining group, has been prospecting in the region of Independencia, State of Ceara.

Company, mainly interested in rutile,

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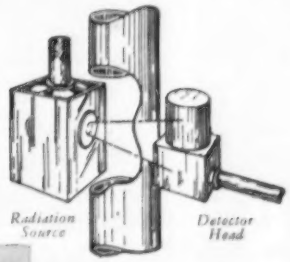

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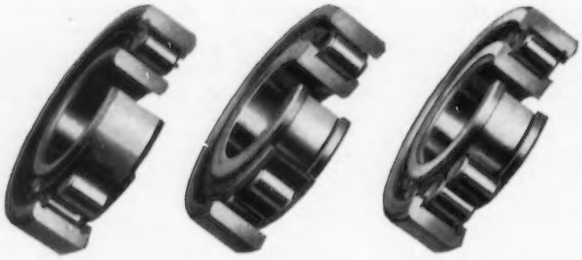

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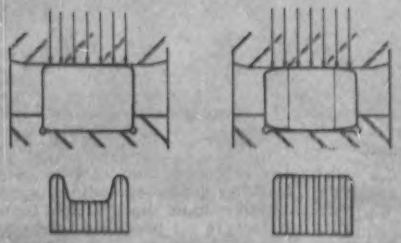
Comparative Stress Patterns under Uniform Loads for Straight and Crowned Cylindrical Rollers



Stress pattern for a straight cylindrical roller under load. Note uneven end-loading.

Stress pattern for crowned roller under load. Crowning radius is exaggerated for clarity.

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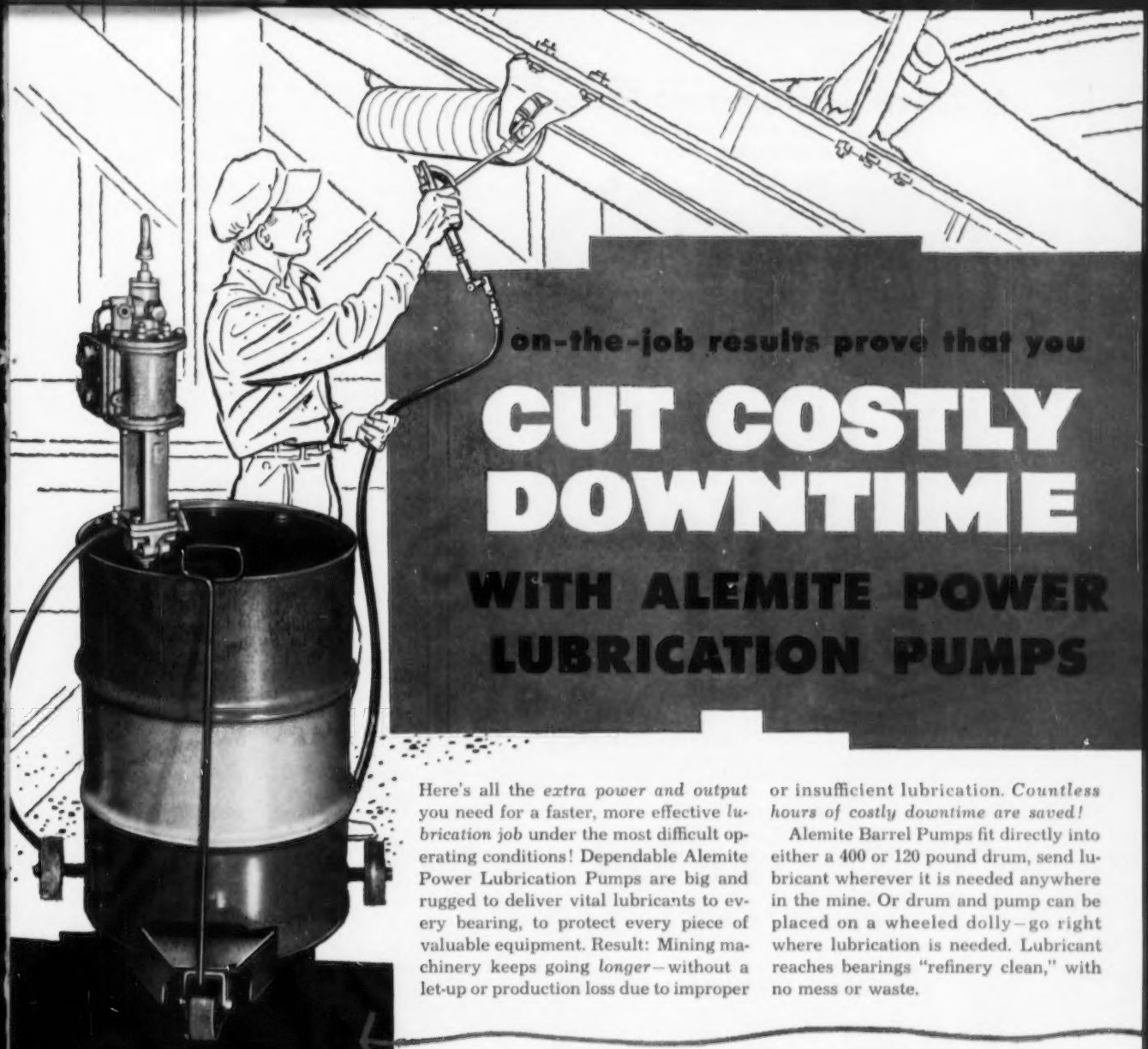

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Alemite Barrel Pumps fit directly into either a 400 or 120 pound drum, send lubricant wherever it is needed anywhere in the mine. Or drum and pump can be placed on a wheeled dolly—go right where lubrication is needed. Lubricant reaches bearings "refinery clean," with no mess or waste.

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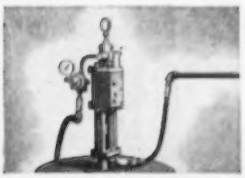

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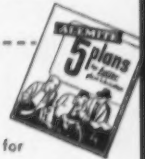

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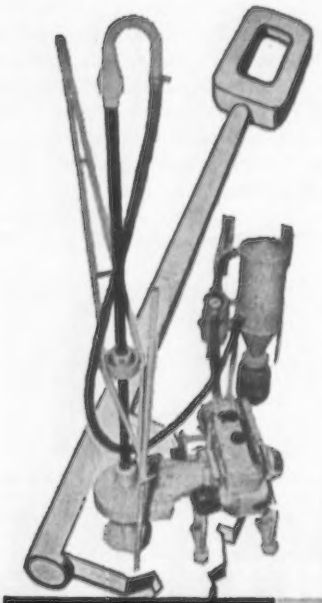

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Brazil *(Continued)*

found deposits, also beryl and other ores. Offers to purchase several tracts of land, including the Fazenda S. Miguel, have been made.

CHILE

Mining of high grade iron ores from relatively small deposits in the Coquimbo and Atacama provinces is on the increase. Cia. Minera Sta. Bárbara is exploiting the El Dorado deposit and some smaller mines in Coquimbo and El Pleito y Colorados mines in Atacama. Company has made arrangements to load its ores at the Guayacan and Cruz Grande wharfs, both built by Bethlehem.

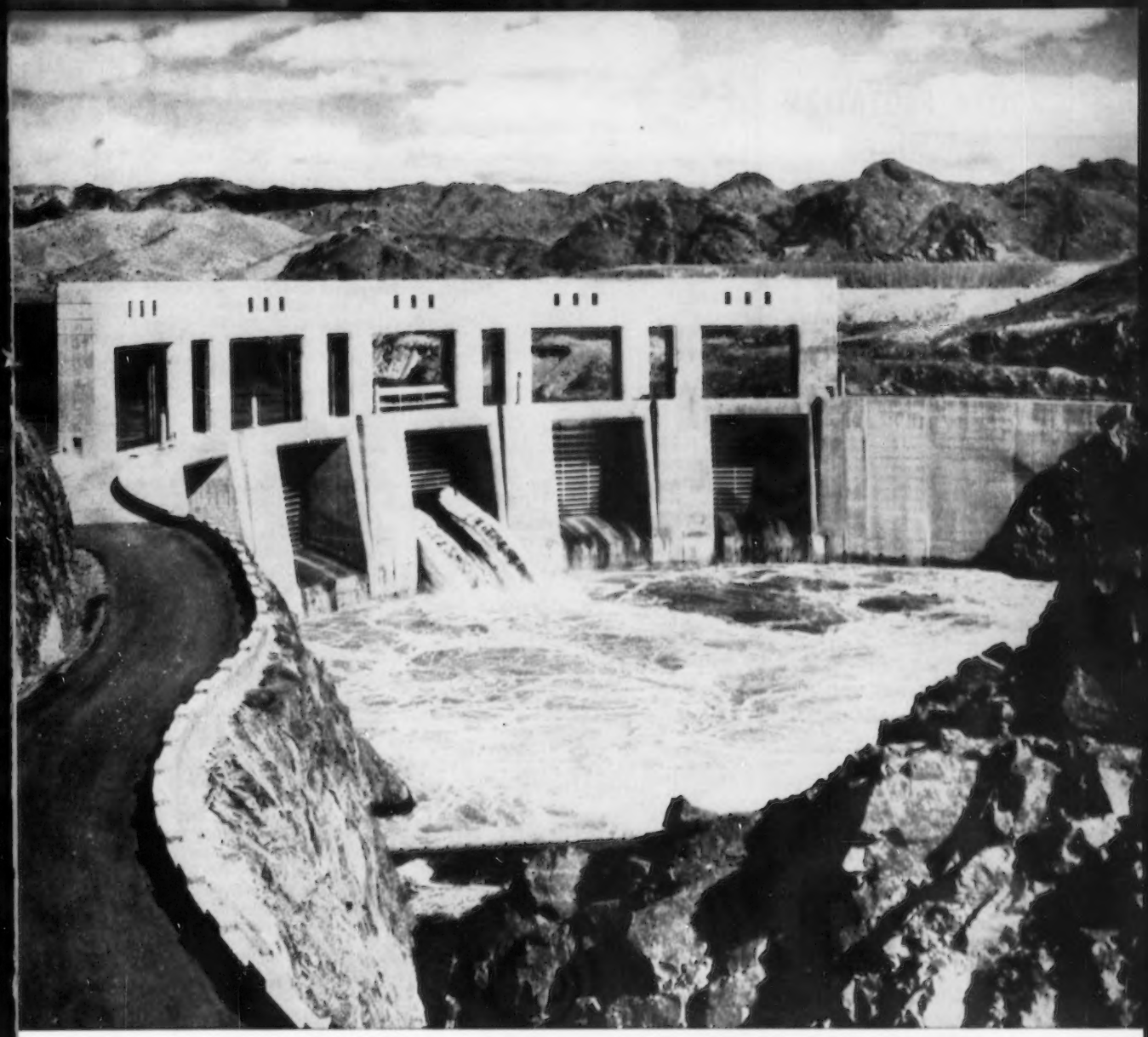
Cia. Minera Santa Fé is mining iron ores in Atacama and shipping through Las Lozas wharf it has built south of the port of Huasco. Cía. Salitrera de Tarapacá and Antofagasta is mining the Cerro Imán iron mine at the rate of 20,000 tpm and shipping through the port of Caldera while Bethlehem Chile Iron Mines is busy exploiting its new El Romeral 20-million ton iron deposit near the town of La Serena and meanwhile is shipping the last million tons of ore mined from El Tofo which has been worked out. All told, five mining companies are exploiting iron ores in Chile whose grades run between 60 and 65% Fe.

Drilling, development work and test work for the leaching plant are being carried out actively at the Mantos Blancos copper mine near Antofagasta by Mauricio Hochschild interests. The plant will have a capacity of 1,000 tpd ore. Sulphide ore found at depth has proved too low grade to be exploitable but grade of the oxide ore is up to expectations.

Cia. Minera Santa Barbara, one of the new mining companies that has been formed lately in Chile to exploit high grade iron ores, is exploring a promising oxidized copper orebody south of the well known copper deposit of Paposo, near Taltal, Antofagasta province.

CORFO (Chilean RFC) has started its 35-tpd contact sulphuric acid plant at the port of Antofagasta. The plant has been built by CORFO according to Lurgi design and under the supervision of their engineers. Plant will produce 98.5% acid using as raw material Chilean brimstone 99.5% fine obtained from nearby volcanic sulphur mines. This plant will supply needed acid to some 20 small leaching copper plants that have been built in the last few years in Antofagasta province to treat the abundant oxidized ores.

Paulino Callejas & Sons, a family firm owner of several mines and mills in northern Chile, has bought the Astillas mine near the town of Vallenar, Atacama Province, and is taking the crushing and milling machinery from Capote Aurífero cyanide mill to start a 100-tpd flotation mill at Astillas. Orebody is low grade copper with abundant pyrite which



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Chile *(Continued)*

was exploited many years ago to supply sulphur to numerous copper smelters in the neighborhood.

In 1955 Chile produced 391,246 metric tons of copper of which Chuqui's output was 209,325 tons, Braden's 141,446 and Andes' 40,475 tons. To this total, 41,-030 metric tons must be added, produced by the medium sized and small mines. Copper production is believed bound to increase in the next few years because of expansion at Chile and Braden, the development of El Salvador and the opening up of La Africana, Anaconda's property near Santiago, where a flotation mill is being constructed.

Glen McCarthy Inc. has signed a 20-year contract with Anglo-Lautaro Nitrate Co. which is renewable for another 15 years, to sell to the nitrate company up to 8-billion Btu's natural gas per year from its oilfields in Bolivia. Anglo-Lautaro is the largest nitrate producer in Chile. A month ago the same oil company had signed a similar contract with Chile Exploration Co. to sell to the copper company up to 12-billion Btu's natural gas per year. A long pipe line will be built from the oilfields down to the copper and nitrate mines. Also the drilling of wells will have to be pushed ahead. The pipe line will extend 470 miles from the oil fields at Villamontes to Chuquicamata, María Elena and Pedro de Valdivia. Cost of the pipe line has been estimated at $35-million.

MEXICO

San Francisco Mines of Mexico after last year setting a company record, is continuing to operate above capacity at its mine-mill plant at San Francisco del Oro in the State of Chihuahua.

Last year a record 760,550 metric tons was put through its flotation mill, designed for a throughput of 60,000 tons a month. Thus far this year San Francisco is milling at a rate of more than 65,000 tons a month of its lead-zinc copper complex sulphide ores which have small gold-silver values.

A company official commented that the above-capacity operation may be traced partially to flowsheet improvements and the fact that there have been no major interruptions to operations recently.

Some 340 miles south and slightly east of El Paso, Texas, the operation has more than 3,000 employees of whom only 35 are foreigners. Two mines feed the mill.

In the Frisco Mine, there are three main operating shafts, deepest of which is 960 meters. Clarines Mine has one shaft, 620m. In general, mining is carried out through shrinkage stoping although there is some cut-and-fill.

Reserves listed as of last Sept. 30, include 3,517,970 metric tons fully blocked, and 1,494,940 metric tons partially blocked out of the complex vein system which runs through both mines.

Lead concentrates are railed to the Cia. Metalúrgica de Peñoles smelter at Torreón, copper concentrates to Asarco's smelter at San Luis Potosí, and zinc concentrates to the Blackwell Zinc Co., Blackwell, Okla.

At San Francisco del Oro, H. B. Hanson is general manager, A. B. O'Neel, assistant general manager; H. G. Dudley, general superintendent; J. T. Humphries, general mine superintendent, and D. L. Brown, mill superintendent.

Largest stockholder is the Union Corp., Ltd., a South African firm which maintains central offices in London.

A new iron mine, El Mamey, is being developed in the west coast State of Colima in conjunction with a new steel mill to be established there. Cia. Impulsora de Industrias Básicas, which has the concession for the mine, reported that exploration thus far has unearthed 12 distinct orebodies of both magnetite and hematite. Reserves as of July 1 were estimated to be 40-million tons averaging 65% Fe. All ore will be used to feed the 1,000-tpd blast furnace at Mexico's principal west coast port city of Manzanillo, 35 miles southwest of the mine. In addition to exploration, current mine work includes the building of access roads. Construction of a sintering plant is being considered.

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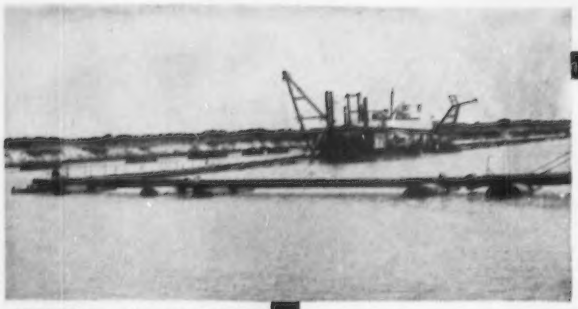

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Murray Construction Co., Waverly, Ohio, specified torque converter drive for this new Allis-Chalmers HD-16. A-C Torque Converter Drive, which is optional on the HD-16 and standard on the HD-21, incorporates Twin Disc Torque Converter components as standard equipment.

Torque Converter Tractors do more work, faster . . . Last Longer!

Two people who should know—both owner and operator of an Allis-Chalmers HD-16C torque converter tractor—unanimously agree that a torq ıe converter crawler *works faster, works longer, lasts longer and produces more.*

As Robert Murray, co-owner of Murray Construction Co., Waverly, Ohio, puts it, "Our new HD-16 tractor is a speedy worker and the torque converter is one of the primary reasons. We also find we haul more yardage for each dollar spent."

Operator Kenneth Austin adds, "Our former tractor would stall loading rock like we encounter on this job, but the '16' goes right through. The torque converter saves clutching and makes it a lot easier for me. At the end of a day's work I'm not nearly as tired."

Murray's HD-16 is used for dozing and for pulling a scraper in rock-like shale—in the relocation of route 73, northwest of Peebles, Ohio. On one stretch of road, fill being hauled 1200 ft. by the 150 hp crawler and a 15-yd. scraper, will raise the highway grade where it crosses a valley.

Torque converter drive offers you *higher work output in less time, and longer equipment life* because it *automatically* matches power to load demand, thus minimizing or eliminating gear shifting . . . it eliminates harmful engine lugging and stalling . . . it cushions *out*—through *fluid* connection—overloads, shock loads and vibrations—providing *longer tractor life* with *less maintenance.*

For these reasons, Allis-Chalmers designed torque converter drive into their HD-16 and HD-21* Crawler Tractors. Since 1940, they have worked closely with Twin Disc Engineers, and have standardized on Twin Disc Torque Converter components.

Specify a torque converter for *your* next Allis-Chalmers HD-16! See your tractor dealer today, for complete information on A-C Torque Converter Drive.

***Torque Converter Drive is standard equipment on the HD-21.**

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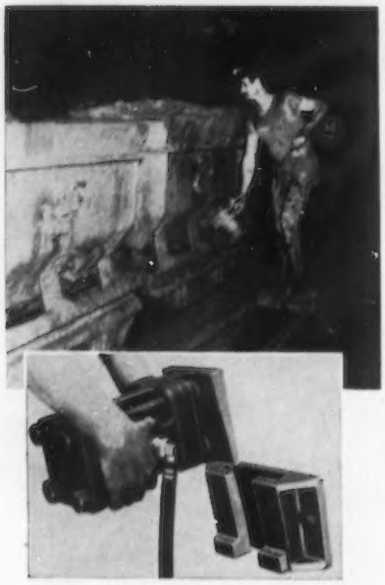

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Mexico *(Continued)*

Compañía Exploradora del Istmo, subsidiary of Texas Gulf Sulphur Co., is preparing to begin operation of its floating 1-million-gpd Frasch process plant on the Isthmus of Tehuantepec. Company reportedly spent more than $8-million developing its Mexican properties (*E&MJ*, June 1955, p 194).

PERU

One hundred-thousand tons of lead, silver, zinc and copper whose mining was formerly uneconomical due to the low metal content of the ore will now be mined, in the recently completed concentration plant built by the Mining Bank of Peru, in the Tonsuyoc zone. Plant is situated 4,300 meters above sea level, 125 km from Lima.

The plant cost 5-million soles ($250,000 at the free exchange rate) and has an initial capacity of 30,000 tons of ore per year, which will later be raised to 100,000 tons.

Plant uses flotation system and has General Electric motors and extractors, to treat the compounds of lead, copper and zinc, mixed with gold and silver, that the seven-mineral region of the area produces.

Initial power supply is 4,000 kw, from a thermoelectric generator. It is planned to proceed immediately to construct a new hydroelectric generator to provide an additional 24,000 kw.

Some 40 small mines of the region, whoses production had practically stopped, have gone back to work as a result of the new plant, and six new small mining companies have been formed.

COSTA RICA

Increased interest in mineral wealth is appearing with activities of U. S. mining companies in the area:

Aluminum Co. of America and Kaiser Aluminum Co. have made extensive surveys in the south central region for bauxite. Alcoa has filed a formal request to exploit some 298 sq km near San Isidro del General.

An agreement has reportedly been signed between a local company and another U. S. firm to examine some 5,000 tons manganese.

A U. S. Government official is consulting with Costa Rican officials in setting up a geological laboratory. Other U. S. and German firms are also reportedly interested in some magnetite deposits.

NICARAGUA

Ventures, Ltd., a Canadian company, controls an area in northeastern Nicaragua which reportedly contains copper ore reserves totaling 4-million tons grading 3% copper.

Title to the land is in the name of Rosita Mines, owned by La Luz Mines, Ltd. which in turn is 70% owned by Ventures, Ltd.

At present, 3,582,000 tons of ore grading 2.91 Cu and 0.027 oz gold per ton have been blocked out. It is expected that 50 tpd copper concentrates grading 50% Cu will be produced. Concentrates will be exported to either the United States or Japan for final refining.

In addition, once an access road has been completed to the area, a 600-tpd capacity plant to treat oxide-sulphide ores will be established.

General area of the copper ore-bearing properties is approximately 35 miles from the present La Luz Mines at Siuna.

HAITI

Reynolds Haitian Mines Inc. was to begin mining operations in Haiti in late July, according to announcement by Reynolds Metals Co., which will receive bauxite from the operation.

Current mining output will be stockpiled during the last half of 1956 in preparation for shipping. Final completion is due in 1957, with regular annual output set at 40,000 tons. Reserve capacity, says the parent firm, is "sufficient to process 90,000 tons per year and to ship larger quantities whenever necessary."

Project involved construction of haulage roads, loading pier and port facilities, and storage. Two 150-tph drying kilns will be installed within the next few months. Ore, says president R. S. Reynolds, is virtually identical in grade with the company's Jamaica deposits.

COLOMBIA

Four contracts for uranium mining have been signed by Ministerio de Minas y Petroleos according to official bulletin. The contractors are planning to form one big company under the name of "Coluranio" in company with a group of investors. The total extension of the zone covered by the four contracts is of 7,000 ha in the Santander and Norte de Santander departments near California, Pamplonita and Cucutilla.

By decree 1452 of June 22, the mining code in Colombia was modified to make possible the exploitation of radioactive minerals as well as of other minerals on the same concession.

VENEZUELA

Interests in Spain and Yugoslavia have started negotiations for purchase of Venezuelan iron ore.

Spanish banker and industrialist Ignacio Fierro revealed that a group in Spain wants to buy "large quantities" of ore from Orinoco Mining Co., Venezuelan subsidiary of U. S. Steel. Fierro was in Venezuela in July in connection with bids for new oil concessions.

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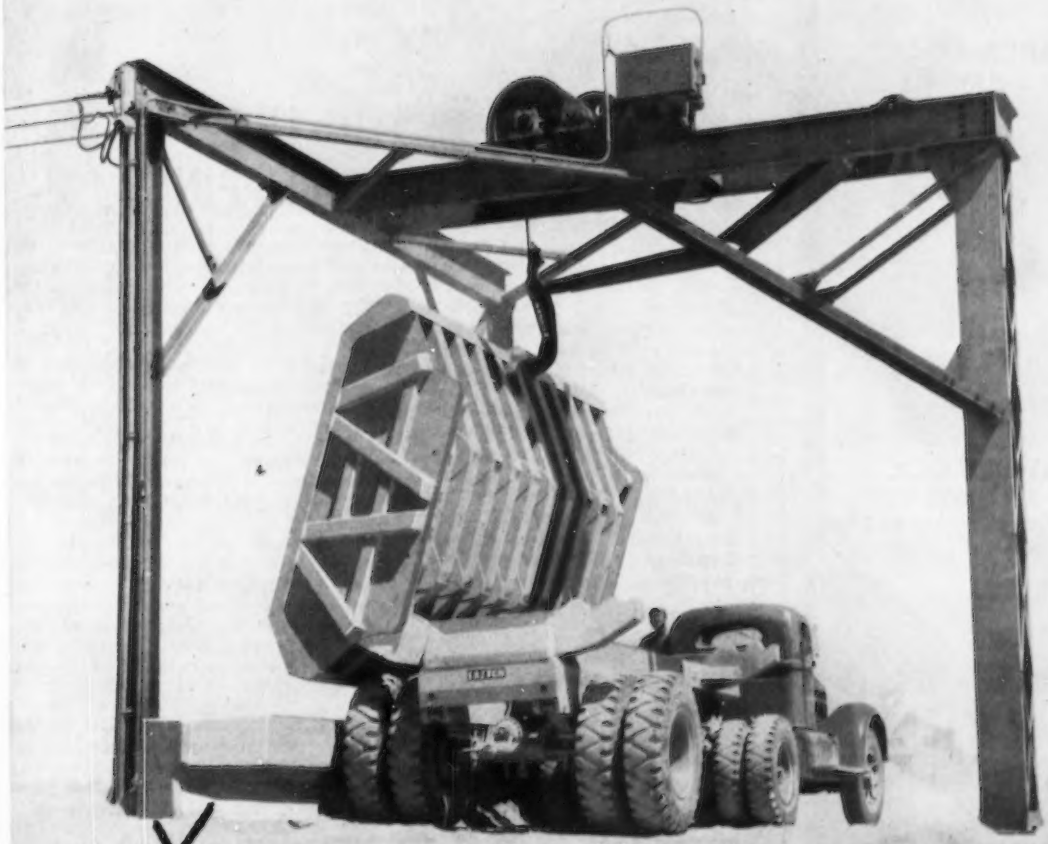

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Venezuela *(Continued)*

Orinoco Mining also reportedly will send a small preliminary shipment of ore to Yugoslavia, having obtained clearance from the Venezuelan Foreign Ministry and the U. S. State department.

The local Italian ambassador announced earlier that the Finsider company of Italy will buy 800,000 tons of ore from Orinoco's Cerro Bolivar mine, while Japan reportedly will purchase 750,000 tons.

Discovery of important deposits of molybdenite in the Guayana region of southeast Venezuela has been announced here by Rafael Borges Rodríguez, owner of mineral properties in Bolívar state.

IN AFRICA

The unusual practice of dividing a mining area horizontally instead of vertically has been adopted for the exploitation of the Van den Heevers Rust in the Free State goldfield. Actual formation is unique, consisting of a series of thick uncorrelated reefs lying above the well-known Leader-Basal reef horizon, the main gold carrier of the whole area.

Twin crosscuts are presently being driven to intersect the upper reefs from the adjoining property, Lorraine G.M., and some 40,000 ft of development of reef will be done before a decision is reached whether an economic mine can be opened up. The work is being undertaken under the technical direction of Anglo-Transvaal Cons.

If the upper reefs do not appear to contain sufficient ore for a mine, then the company will be entitled to explore the lower reefs and open a mine to exploit both horizons. If the upper reefs are economic by themselves, the other partner, General Exploration Free State, will open up the lower reef—provided it is payable—and work it separately.

South African Council of Scientific and Industrial Research is continuing its work on rockbursts. Among the lines of approach are destressing operations aimed at causing crushing of stope faces artificially. Holes are drilled 10 ft deep and 2 to 5 ft apart almost normal to the face and are blasted weekly, in addition to normal rock-breaking holes. The destressing holes do not necessarily result in breaking ore, but crush the solid zone ahead, thus shifting the zone of high stress further back into the solid and creating a cushion of crushed rock between the dangerous highly-stressed solid zone and the working face. Acoustic equipment has been developed to measure the depths in a de-stressing hole, but this is as yet in the experimental stage.

Prospects for improved railages of chrome ore from Rhodesia to the U.S. and Britain "are looking more hopeful than at any time in the past five years," according to C. A. Bott, vice president of the American-owned Rhodesian Vanadium Corp. This company is the second largest chrome producer in Central Africa.

Large tonnages of chrome ore have been stockpiled during recent years because the Rhodesia Railways system has been unable to provide sufficient carrying capacity to transport the ore to the port of Beira in Portuguese East Africa.

During 1955 the railways transported 449,000 tons of chrome ore to the coast. Rhodesian chrome mines, when working at full present capacity, produce about 1-million tons of ore a year.

One reason for the improved position has been the railways' decision to route 3,000 tons of asbestos a month from the Mashaba district of Rhodesia through the port of Lourenco Marques, carrying the asbestos by road to link with the railway line to the port. This change makes sufficient trucks available to carry an additional 5,000 tons of chrome ore a month to the port of Beira.

At present about 750,000 tons of chrome ore are lying in stockpiles awaiting transport.

IN THE PHILIPPINES

First shipments of iron ore from the Mati mine in Davao, operated by the Atlas Co., were to commence about the end of June. It is expected to ship 180,000 tons by the end of 1956.

Copper production in the Philippines in 1956 will be at least double 1955 output and replace both iron and chrome ore exports in rank.

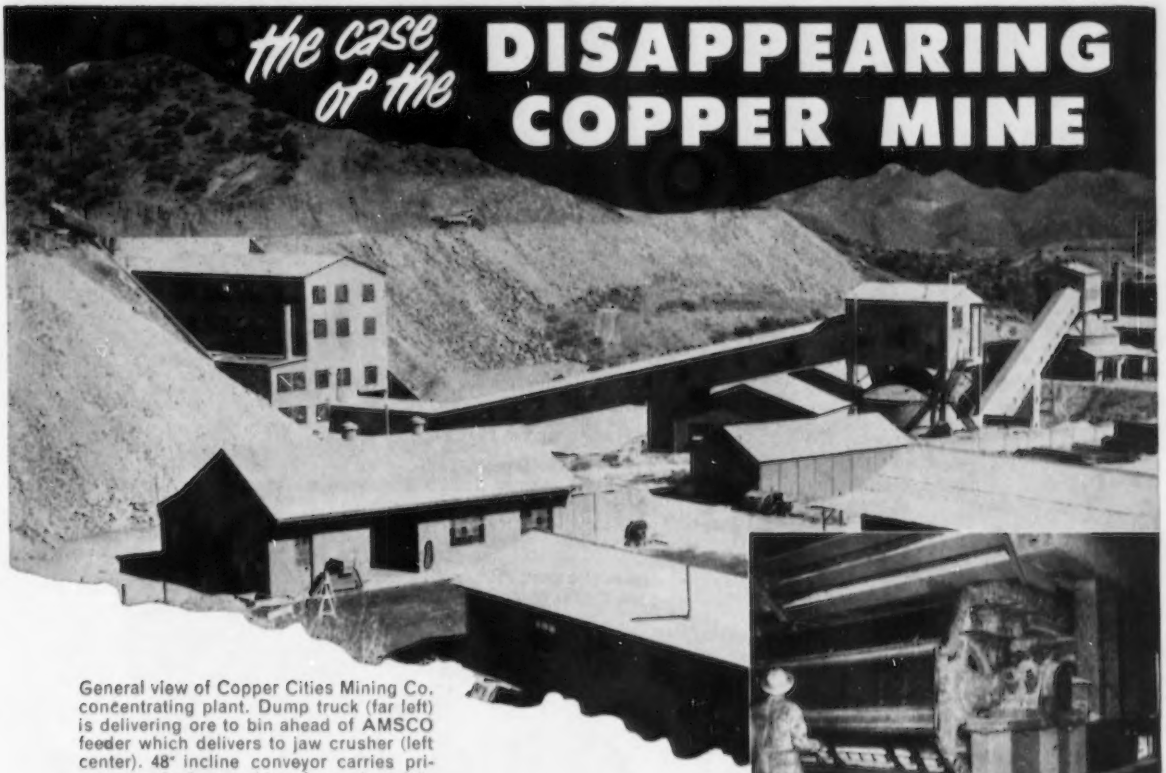
Samar Mining Co. expects to have its iron mines in Sibuguey in production before its present output from the Camcueva deposit in Samar is exhausted. Sibuguey ores are four or five times as large as Camcueva and are expected to have a life of 30 to 40 years. According to reports of Japanese geologists employed by Elizalde & Co. to examine the Sibuguey deposit, it lies in an area that contains one of the largest iron deposits in the Orient.

Baguio Gold Mining Co. milled 12,900 tons of ore in May averaging 0.21 oz gold per ton, or about $11.40 per ton. The high return per ton resulted from payment of the gold subsidy.

The Emergency Gold Mining Assistance Act, extending the government subsidy to gold mines for two years until June 30, 1958 was passed by the Philippine Congress. Bill also extends subsidy privileges to four base metal mining companies that produce gold as a by-product, Atlas Consolidated, Lepanto, Masara and Paracale Gumaus.

Vigorous protest has been made by the Philippine SEC and the Bureau of Mines against the country's corporation law which prohibits corporations from being in any way interested in another firm engaged in the same business. Removal of such restriction would result in an increase of 30% in mineral production.

the case of the DISAPPEARING COPPER MINE



General view of Copper Cities Mining Co. concentrating plant. Dump truck (far left) is delivering ore to bin ahead of AMSCO feeder which delivers to jaw crusher (left center). 48" incline conveyor carries primary crushed ore to bins, from where it is fed to secondary crusher. Secondary crush is carried on inclined conveyor to fine crusher building in background.

Huge AMSCO manganese steel horizontal pan feeder, 10'6" by 25', has a 20 h.p. drive. Capacity ranges from 500 to 1500 tons of ore per hr. 27,500,000 tons of ore were handled by this feeder before replacement of pan and chain was made. View shows tailshaft assembly, pans, rollers, etc.

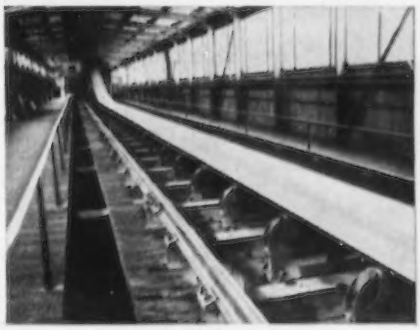
A true story of how ONE S-A conveyor system carried away 41 million tons of ore!

The Castle Dome Copper Mine was finished—its metal ore exhausted. Actual records show that from date of installation until cease operation orders went out about two years ago, 41 million tons of ore from this mine had moved through a STEPHENS-ADAMSON engineered conveyor system!

Castle Dome was finished—but the S-A conveying system, time-tested and toughened by steady usage, was ready and raring for further conquests.

Today, the Copper Cities Mining Company is using this same S-A equipment on its Miami, Arizona properties. And here it is delivering the same steady trouble-free performance as before. In fact, since August 1954, over 5 million tons of copper sulphide ore has been handled at the new site.

Moving these tremendous tonnages the S-A way spells bulk handling with the greatest economy and efficiency that modern engineering and manufacturing skills can provide.



This is the S-A 42" belt conveyor which carries fine ore over 400 ft. of bins in mill building. In background is motor driven tripper for discharge of belt at any point along its length. Note 6" diameter SACON idlers which carry belt.

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Intense heat no problem for Super Belts

This hydraulic press at Hackney Iron and Steel Co., Enid, Oklahoma, shapes red hot steel plate into tank heads.

The flat leather belt formerly used on this type of press, would stretch, slip, and come off. Tightening the belts only overloaded the bearings. For this press, a Gates Super Vulco Rope drive was chosen because it withstands the near-by intense heat, and its extra horsepower capacity permits lighter weight sheaves; thereby reducing load on bearings.

Claude King, maintenance superintendent, reports: "This Gates V-belt drive has operated 8 hours a day for 5 years without lost time due to maintenance."

Super Belts on vibrator last 7 times longer

James Gann, general superintendent of John B. LaGarde, Inc., Anniston, Alabama, reports:

"Practically every condition exists to shorten V-belt life on the vibrator drive of this concrete block machine. The machine starts and stops 4 times a minute. Intense vibration must be absorbed by the V-belts to protect motor and bearings. Sand and concrete, oil and grease all get into the drive.

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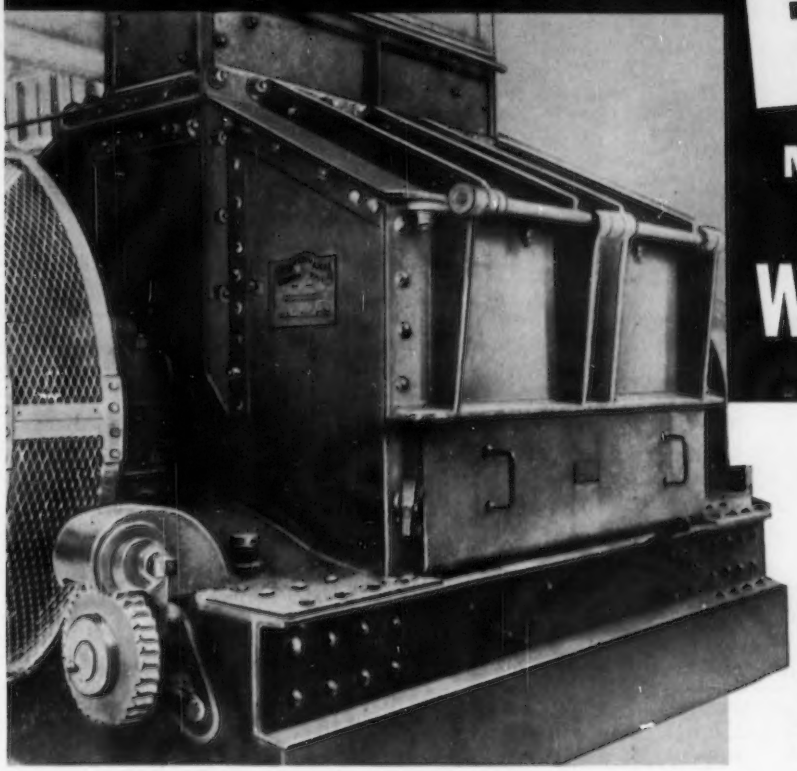

This Central Feed Reversible Hammermill is one of an extensive line of crushers made by Pennsylvania Crusher Division of Bath Iron Works Corporation, in which TISCO Manganese Steel Wear Parts are used.

All wear parts of this Hammermill are, of course, exposed to enormous impact and abrasion. That is why hammers, screen bars, breaker blocks and liners are made of tough, work-hardening TISCO Manganese Steel. When subjected to this combination of destructive forces, TISCO Manganese Steel outlasts other materials in the ratio of five to one or better.

In many other types of heavy-duty equipment, too, this extremely durable metal —one of several TISCO Wear-Resisting Alloys—is helping to keep maintenance costs and downtime for repairs at a minimum.

Get in touch with Taylor-Wharton if you have a problem involving impact or abrasion—or a combination of both.

TISCO Manganese Steel Hammer of the type used in Pennsylvania Hammermills

TISCO Manganese Steel Screen Bar as used in Pennsylvania Hammermills

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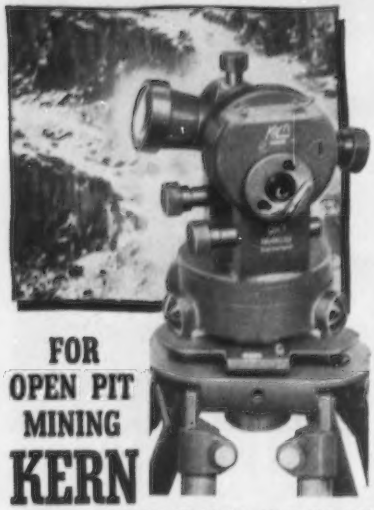

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MORE ANNUAL REPORTS

American Zinc, Lead & Smelting Co. announced purchase of an interest in Uranium Reduction Co., which is building a mill at Moab, Utah, where it will handle ore from Utex Exploration Co. mines.

Activities at its various mines, mills and smelters were as follows: Grasseli and Athletic were reconditioned and produced at a reduced tonnage during the year; Mascot No. 2 and North Friends Station were at capacity; Young produced 747 tons development ore, is now mining at 1,000 tpd rate, hopes to reach 1,500 figure by mid-1956; Coy shaft sinking on the Emert property was completed. Underground development will start this year; Piquette Joint Venture, Wisconsin mine, was started up; the 4,600-acre claim and 800-ton mill of the Vinegar Hill Zinc Co. were purchased.

Also in Wisconsin, American Zinc took leases on Cuba City Mining Co. property with reserves estimated at 100,000 tons, 60% zinc concentrate. Picher Okla. mines worked at capacity until year-end, then shut down. Plant started again in January and will continue through the year at 25% capacity. Grandview mine and Metaline Falls concentrator, Wash. operated most of the year.

Total production from all American Zinc mines was 82,627 tons concentrate; expected to reach 100,000 tons per year by end 1956.

Lead Hill Mine and British Columbia claims received only assessment work during 1955. Ouray mill and mine equipment was sold.

American Zinc's Heavy-Media process is now being used in 203 plants in 27 countries to treat 24 different minerals. Refineries at Monsanto, Hillsboro, and Dumas were operated at full capacity. Fairmont worked at zinc roasting, acid production, cadmium and germanium. Fort Smith was started up and will continue. Net income for the year was $2,592,232.

National Lead Co. reported that production and new construction at Nicaro was moving ahead. Company is building a nickel metal refinery at Philadelphia, which will use nickel oxide sinter from Nicaro. Mine and mill at Tahawus was expanding 25%. Program will be complete this year. Several important discoveries of ilmenite were reported. One is one-half mile from Tahawus and is expected to add 50-million tons to ore reserves of the company. Additional deposits found in Florida and Norway added 5- and 100-million tons respectively.

National is investigating a metal-organic jet and rocket fuel. Pilot plant is already producing limited amounts. Birmingham, Ala. pilot plant beneficiating low-grade iron ore was successful. Project is in cooperation with Republic Steel Corp. Commercial plant is being designed to treat this non-magnetic ore. Concentrates will run 25-85% Fe.

The $20-million expansion program of AEC's Fernald plant, operated by National Lead, is nearly completed. Plant processes uranium and thorium metals for AEC. Company constructed a rutile concentrator at Cudgen, New South Wales and acquired a major interest in Mineral Deposits Pty, Ltd., Southport, Queensland.

U. S. Steel Corp. mining companies produced some 51.9-million tons iron ore during 1955. Oliver Iron Mining Division shipped 40.2-million tons. Orinoco mining Co. shipped 5-million tons and operations in South and West accounted for 6.1-million tons.

Inspiration Consolidated Copper Co. finished the year without the strikes that slowed production at some other copper producers and showed net income of $8,321,112. During the year, the company approved final plans on converting the Inspiration plant into a leach and then float, due process. Cost of conversion will be $5,660,000. By year end, dismantling of old equipment was nearly complete. Slime flotation plant was relocated and operating. When completed, new leach and float plant will have 42,500 tons copper annual capacity. Process will recover more of the copper now going down the tail race and will add some 350-million lb copper to total reserves.

Development work at Christmas mine was encouraging; nearby New York property will be drilled this year.

Inspiration produced 64,367,812 lb copper from ore and 11,860,313 lb from leaching in place. Process for redissolving cement copper has been developed and put into practice.

Tennessee Corp. added a new sulphuric acid plant at East Tampa to increase triple phosphate capacity. Uranium plant to recover the metal from phosphate at East Tampa will be finished this year. Tennessee Copper Co. puchased all the facilities of a New England sodium hydrosulphite, sodium sulphoxalate and zinc oxide manufacturer and the units will be installed at Copperhill by the end of September. Net income for 1955 was $7,661,627.

St. Joseph Lead Co. reported annual net income at $12,729,820. Considerable progress was reported on enlarging the capacity at Josephtown toward the 12,000 ton per month refined zinc level. Program will be completed by early 1957. A 100,000-kw coal-fired steam power plant will be set up at Josephtown.

Lead Belt and Edwards-Balmat area mines operated smoothly throughout the year. Indian Creek mine, Washington, now in its second year was at 1200 tpd ore rate and will soon approach the 2,000-tpd design figure. Rehabilitation program at Compania Minera Aguilar, S. A. was almost complete. Two new copper prospects in Argentina were being drilled and a third property is being negotiated for.

Pilot plant at Brunswick Mining & Smelting Corp., Ltd. was shut down in June last year, when results proved unsatisfactory. Plant will go back to work this spring, when results of extensive research program at Battelle Memorial Institute can be tried out. Net income of Mine La Motte (50% St. Joe) was used in the new development program and the sinking of a new shaft.

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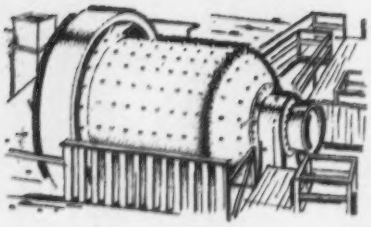

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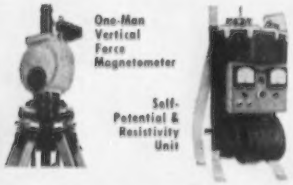

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Annual Reports *(Continued)*

Olin Mathieson Chemical Corp. made arrangements to finance and construct new aluminum facilities at Clarington, Ohio. Project will include an alumina, reduction and rolling mill, and will cost $120-million. Associated with Olin will be Pittsburgh Consolidated Coal Co. and American Gas & Electric Co. Coal will come from local mines and bauxite from Surinam.

Gaspé Copper Mines, Ltd. has ore reserves estimated at 67-million tons, 1.3% Cu. No further drilling has been done since 1952. Trackless mining is employed at the mine. Milling started last spring and smelter poured first copper in December. Mine, mill and smelter cost $39-million. Mill has 6,500 tpd capacity. No work was done at Copper Mountain. Refinery is at Montreal East.

Pamour Porcupine Mines, Ltd. paid no dividends during the year. Gold ore reserves at year end were 1,618,811 tons, 0.101% gold.

Consolidated Coppermines Corp. had earnings of $6,249300. Some 16-million tons low grade ore were added to reserves. Drilling continues and more tonnage is expected. Tripp Pit was put into production. Exploration during the year involved scouting prospects in Arizona, California, Wyoming and Nevada. Nothing exciting was reported. Geophysical exploration program in Canada was continued.

Jones & Laughlin Steel Corp. operated their five Mesabi mines, Benson mine in New York and the underground high grade in Negaunee, Mich. Total production was 5,832,000 tons iron ore. Total ore reserves were 180-million tons, plus considerable tonnage of lean ore requiring beneficiation.

Vanadium Corp. of America net profit for 1955 was reported at $5,429,008. VCA spent $2-million plus on plant and property during the year; including purchase of manganese property in Northern Rhodesia and pilot plant at Cambridge, Ohio. Manganese property covers 200 sq miles. Pilot plant will work on ferro alloys.

VCA chrome ore mine in Southern Rhodesia increased output over 1954 figure. On the Colorado Plateau, concentrator output at Monument No. 2 was increased. New properties for vanadium-uranium were acquired. At Marysvale, the development work below 500 level indicates additional reserves at hand. Vanadium production in Peru was further curtailed. Development at Mina Ragrs continued, while Jumasha was maintained on standby. This was done because ore reserves on the Colorado Plateau are adequate and the company wished to conserve Peruvian ore.

Polaris Mining Co. showed a net profit for the year of $282,379. No dividend was paid for 1st quarter 1956. Ore production from Omega-Rotbart and Silver Summit showed a marked decline in grade. This and the increase in mining costs has affected net earnings.

Hecla Mining Co. realized a net income of $495,956 for the year. Rock Creek property was sold, due to lack of commercial ore. Radon Group has completed surface plant and shaft to 700 ft. Development ore to date amounted to 3,290 tons, 0.49% U_3O_8. Hecla and the Bunker Hill Co. are developing Mullan, Idaho property. Surface plant is up and sinking was started in February 1956.

Calumet & Hecla, Inc. produced some 27-million lb copper from Calumet Division. Major project was the unwatering of the Osceola lode. Mining started on lower levels at No. 13 shaft. No. 6 was about 70% unwatered. Production of copper from Tamarack Reclamation Plant continued. Although Tamarack sands have not been exhausted, reclamation was started on Ahmeek bank sands to keep output high.

Exploration in Michigan copper district was encouraging. Centennial 48 level has opened into 3,000 ft of a previously unknown orebody. Results at Allouez No. 3 were more good ore. At Mass, Mich., ore was found in better grade than at Calumet. Canoncito, Mexico orebody was found to be small and low grade. Lease will be dropped. At Grants, N. M., 3,000 acres were leased and drilling is encouraging. Gallup area exploration will start this year.

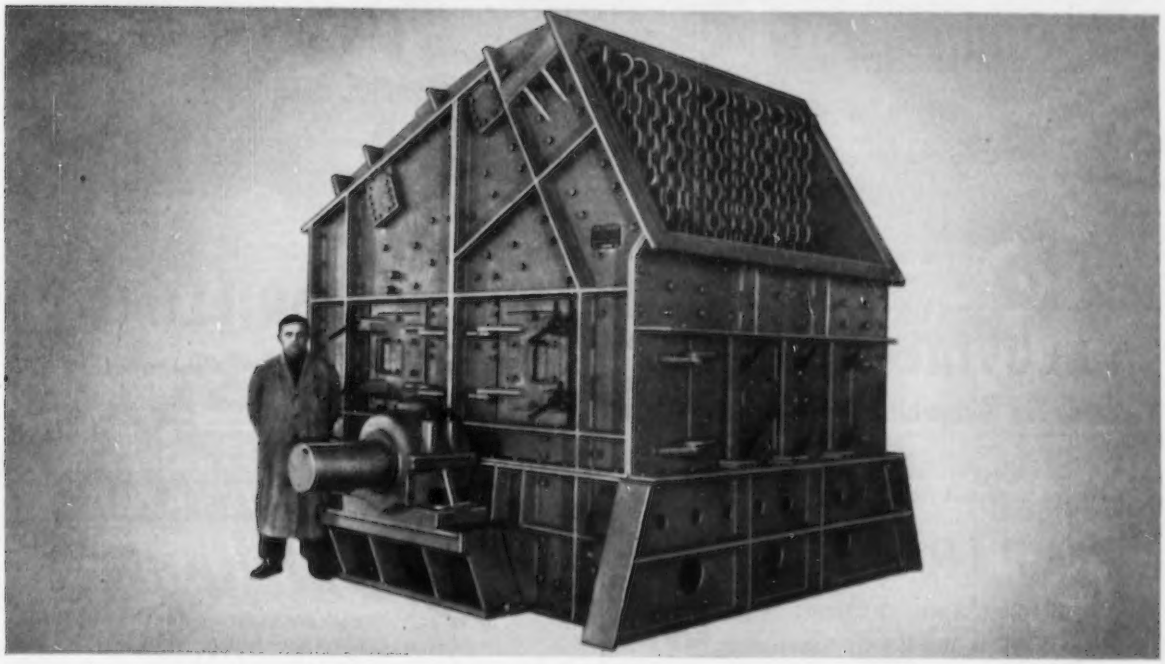
Day Mines, Inc. increased ore reserves to 524,110 tons at the five company mines in Idaho. Dayrock is developing ore below 1100 level; above the 800, ore is about 90% extracted. Monitor unit remained inactive, except for two leases. Hercules developed considerable good continuous zinc-lead-silver ore on DMEA loan. Galena mine was put into operation in September. Gold Hunter is being retimbered and dewatered. Sunset continued to show profit. A number of uranium properties were examined and dropped.

Aluminum Co. of America primary aluminum output in 1955 was 702,000 tons. Net income was $87,600,808. New smelter capacity added in 1955 or scheduled for 1956 completion will add another 76,000 tons to total capacity. Studies are being made to add 150,000 tons capacity in the Ohio valley area. Kitimat project has been shelved and emphasis is being directed toward coal-fired power generation facilities in the U. S.

Alco will build an alumina plant at Point Comfort, Tex. Request has been made to construct a dam and hydro plant at Badin, N. C., on the Yadkin River.

Pechiney, in their annual report, stated that company expansion program started in 1949 was completed. Aluminum production is now 107,920 tons. A new aluminum plant will be built at Edea, Cameroons. Plant will be on stream in 1957, reaching full capacity by 1959. Another aluminum plant might be scheduled for Metropolitan France, according to chairman, M. Piaton. Net income for all Pechiney operations during 1955 was 1,824,990,707 francs.

WIDER HORIZONS



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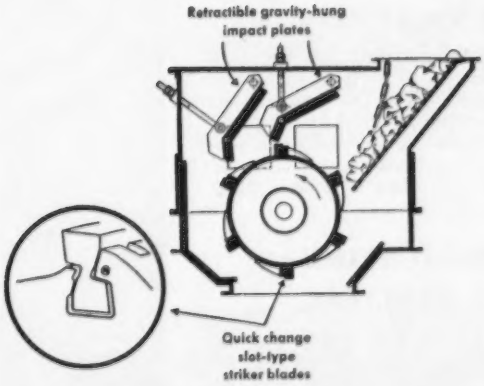

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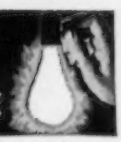

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1—350 cfm IR, type XRB, 75 HP motor

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1—9" x 36" Cedar Rapids
1—10 x 20 Denver
1—18 x 36 Traylor, 75 HP motor
1—20 x 36 Cedar Rapids
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1—2'4" Traylor Gyratory

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1—4' — 4 leaf — Eimco, complete
1—4' — 4 leaf — Oliver American
1—6' — 2 leaf — American, complete
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1—#250 Denver unit cell
32—Fagergren 56" x 56", type Level, Model HS in units of one to 4 cells
20—Galigher Agitair, 2 cell per unit, size 48" x 48"
2—4 cell #30 Denver Sub A

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1—300 KW GMC 2300 V
1—300 KW IR, 2300 V
2—50 KW International 220 V
3—100 KW Caterpillar, 480 V

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1—400 HP Stearns-Rogers, single drum
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1—Sullivan Model LIII
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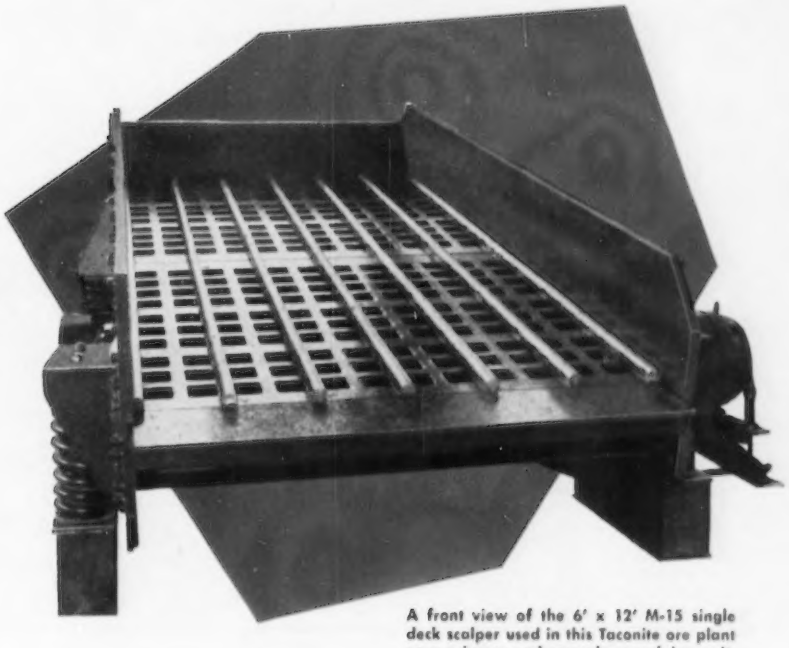
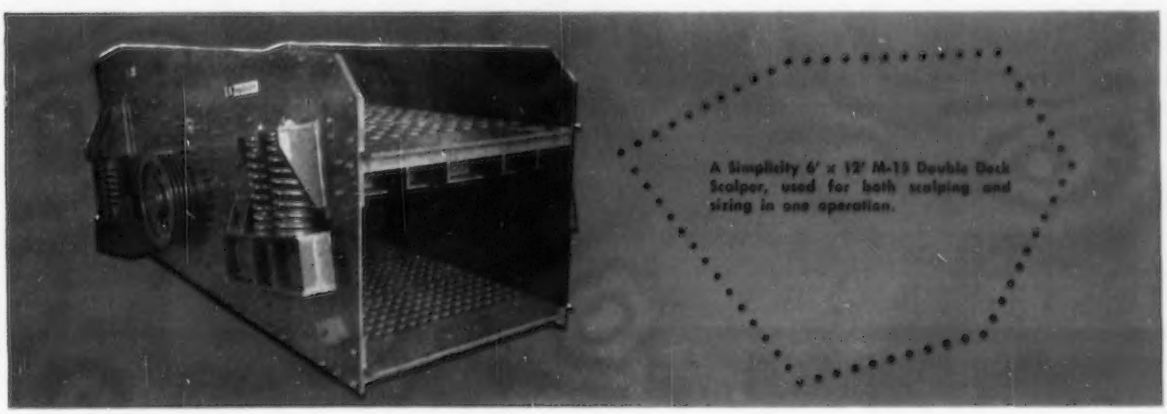
430 long tons per hour of Taconite ore handled by this SIMPLICITY scalper



A front view of the 6' x 12' M-15 single deck scalper used in this Taconite ore plant as a primary and secondary scalping unit.

Lumps up to 24" of hard, tough, extremely abrasive Taconite ore are scalped by this Simplicity 6' x 12' Model M-15, at a throughput rate of 430 long tons an hour. This primary scalper is accompanied on the job by six other heavy duty Simplicity units, all of them, of course, handling the same gruelling fast flow of Taconite. First operation in the Taconite processing is feeding the ore to the primary scalper: this is done by a Simplicity 6' x 16' Model MA Feeder. Large chunks are fed off the 6' x 12' single deck M-15 primary scalper onto a Simplicity 6' x 20' Picking Table, where all obvious shale, stone, and other foreign material is removed. From here, the ore is put through a jaw crusher, and from the crusher two Simplicity 5' x 20' Feeders set in tandem deliver it to the secondary scalper. This unit, like the primary, is a Simplicity M-15 6' x 12' Heavy Duty Scalper. Fines from this operation now go to a Simplicity Double Deck 6' x 12' M-15 Scalper, where they are both scalped again and graded. Larger lumps are fed through a cone crusher, then they are likewise scalped and graded. The ore is now ready for extraction. This whole plant is set to work 24 hours a day seven days a week . . . and the rugged Simplicity equipment assures that down time will be negligible. Write today for details of Simplicity units for your own operation.



A Simplicity 6' x 12' M-15 Double Deck Scalper, used for both scalping and sizing in one operation.

180

SALES REPRESENTATIVES IN ALL PARTS OF THE U.S.A.
FOR CANADA: SIMPLICITY MATERIALS HANDLING LIMITED, GUELPH, ONTARIO
FOR EXPORT: BROWN AND SITES, 50 CHURCH ST., NEW YORK 7, N. Y.

Simplicity
TRADE MARK REGISTERED
ENGINEERING COMPANY • DURAND 4, MICHIGAN

How a new **CAT*** No. 12 can

STEP UP YOUR MINE'S EFFICIENCY 3 WAYS

This new Caterpillar No. 12 Motor Grader maintains 16 miles of haul road and 'dozes truck spillage at the Hill-Trumbull Mine, Marble, Minn. It is owned by the Mesaba-Cliffs Iron Company and operated by the Cleveland-Cliffs Mining Company of Cleveland, Ohio. In building and maintaining haul roads for faster cycle times and reduced wear and tear on equipment, in 'dozing and clean-up work, the new Caterpillar No. 12 does a big and important job. Here is how it can do it at lower cost in *your* mine:

1. LOWER OPERATING COST. The new No. 12 delivers its 115 HP on non-premium, low-cost fuels. Its new oil clutch gives you longer clutch life, easier operation, and as much as 1500 hours between clutch adjustments. Tubeless tires (furnished at no extra cost) run cooler, last longer, and eliminate the tube and flap down time of old-fashioned tires.

2. LONGER WORK LIFE. Like all Caterpillar Motor Graders, the No. 12 is built—not just assembled—by a single manufacturer. This means traditionally sound Caterpillar ruggedness and workmanship, and careful balancing of engine and blade capacity for long life and high efficiency. And it means a single source for parts and service—your reliable Caterpillar Dealer.

3. INCREASED PRODUCTION. Positive, non-creep controls, easy "feel-of-the-road" steering, sure-footed traction with engine positioned over the driving wheels, quick-change blade positioning, unobstructed visibility—all these are good reasons why operators *like* the Caterpillar No. 12 Motor Grader, and do more efficient work on any job.

Your Caterpillar Dealer will demonstrate these and other features of the fast-working, long-lasting No. 12 Motor Grader. See him for proof that the Cat No. 12 will do more work at less cost on *your* job than any other grader.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

99% OF ALL CAT MOTOR GRADERS EVER BUILT ARE STILL AT WORK

TRUCO CORING BIT

TRUCO CONCAVE BLAST HOLE BIT

TRUCO PILOT BIT

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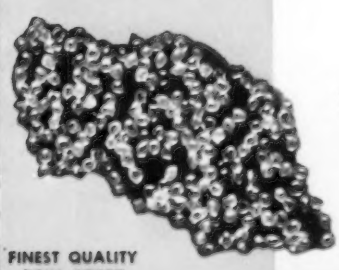
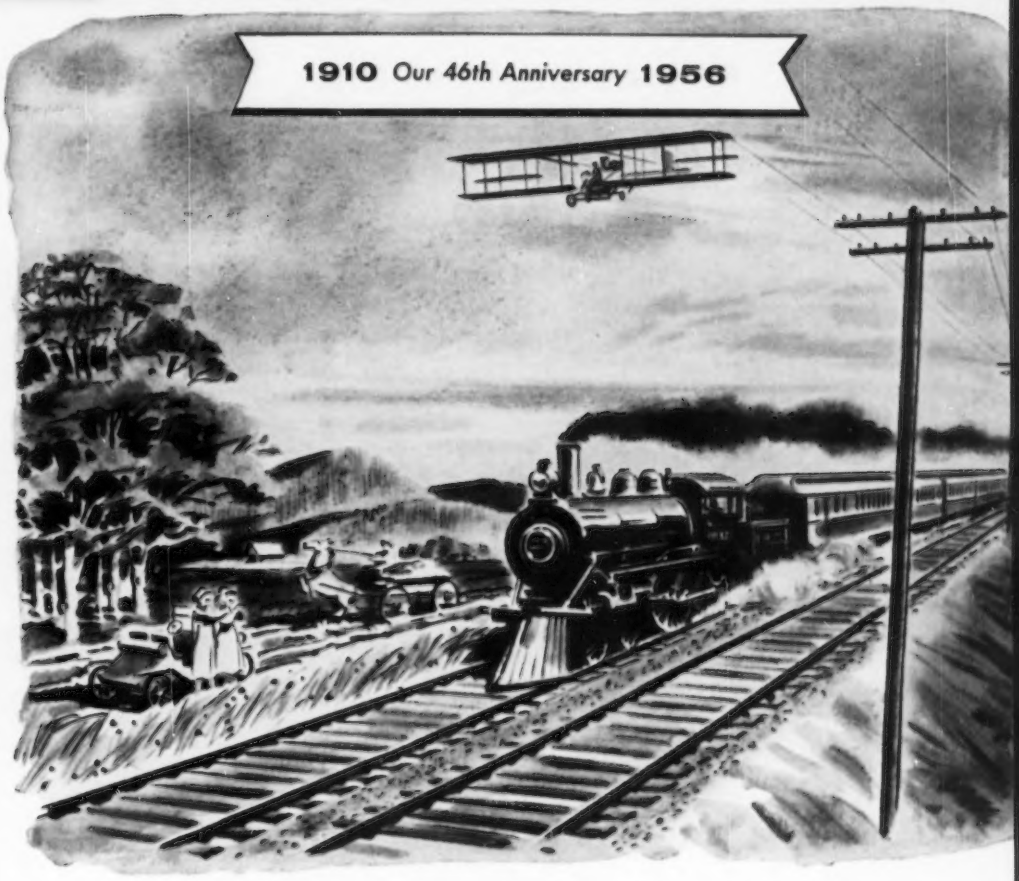
TRUCO REAMING SHELLS

TRUCO STANDARD OIL FIELD BIT



FINEST QUALITY DRILL BORTZ

1910 *Our 46th Anniversary* **1956**



man on the wing

Great things were happening in aviation 46 years ago when we launched the idea of scientifically selected industrial diamonds and set up our little factory to make the diamond tools that were to be so vital to aviation.

Louis Bleriot had won $5,000 offered by London Daily Mail for the first airplane flight across the English Channel. Piloting his 24 H.P., 450 pound monoplane to the dizzy height of 250 feet, he had spanned the 21 miles of open water in 37 minutes. The challenge echoed across the Atlantic and 1910 saw a brilliant parade of dramatic "firsts."

Glenn Curtis won $10,000 offered by New York World in a 150 mile race with a train. Charlie Hamilton won $10,000 offered by New York and Philadelphia newspapers for flying a round trip between those cities in one day. Walt Brookins won $5,000 offered by Atlantic City Aero Club for reaching a height of one mile.

Ely took off from the deck of a cruiser and flew two miles to Norfolk in the first ship take-off flight. Phil Parmalee got $5,000 for flying five bolts of silk from Dayton to Columbus, Ohio, in a store publicity stunt—the first merchandise shipped by air.

Another first in those early years was Engineered Diamond Tools followed, later, by Truco Engineered Diamond Bits containing the finest selected diamonds, hand set to bring each sharpest cutting face to the work. In virtually every major drilling operation in the world these bits are now famous for fast, accurate and dependable penetration in every formation and for their ability to reduce rig time and footage costs. May we send you a copy of the Truco Diamond Bit Catalog?

TRUCO DIAMOND BITS

by

WHEEL TRUEING TOOL COMPANY

3200 W. Davison Avenue, Detroit 38, Michigan

WHEEL TRUEING TOOL CO. OF CANADA, LTD.
575 Langlois Avenue, Windsor, Ont., Canada

Drills hard taconite easy with TIMKEN® bearings taking the loads

THIS mammoth rotary airblast drill, the Joy Super Heavyweight Champion, is designed to make easy going of 9″ to 12″ holes through the hardest taconite. One big reason: to withstand the heavy loads, Joy engineers mount the rotary table and gear shafts on a total of 22 Timken® tapered roller bearings.

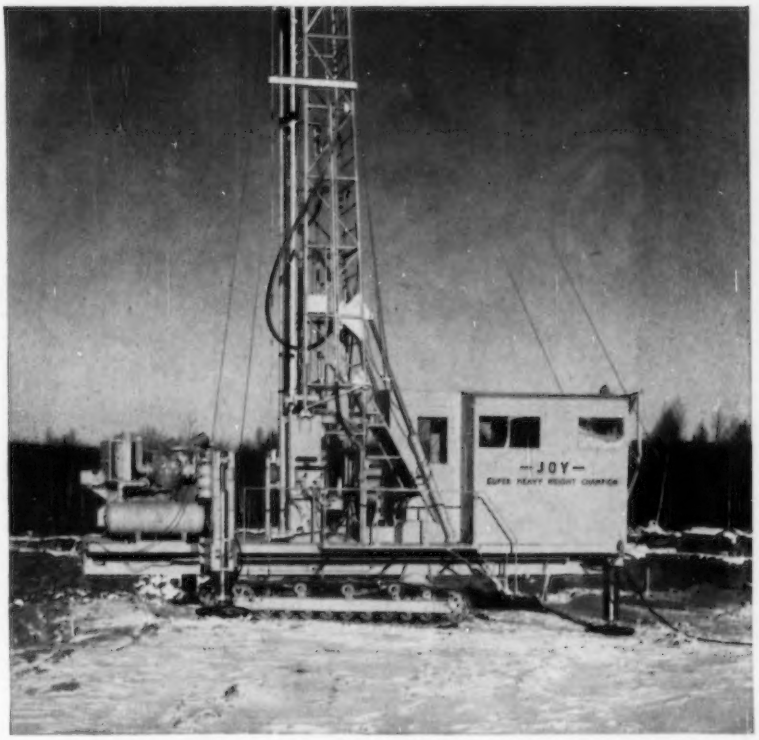
Timken bearings take extra-heavy loads because full line contact between rollers and races gives them extra capacity. And because of their tapered construction, Timken bearings take radial and thrust loads in *any* combination. Shafts are held in rigid alignment. This means more accurate gear mesh, less gear wear, longer gear life. Fewer costly breakdowns in the field.

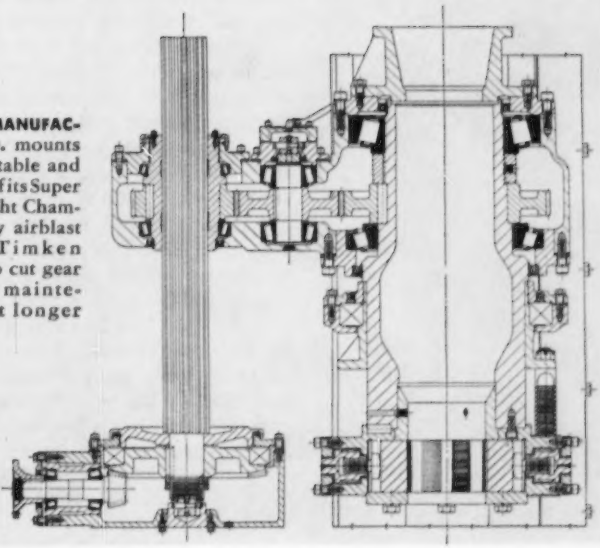
With Timken bearings, friction is practically eliminated. They are designed by geometric law to give true rolling motion, manufactured to almost microscopic limits to live up to their design. We even make our own fine alloy bearing steel. We're the only bearing manufacturer in America that does.

Timken bearings cut maintenance and lubrication expense, too. They keep shafts concentric with housings, making closures more effective. Lubricant is kept in, dirt and moisture kept out.

To be sure of long life and low maintenance in the machines you buy or build—to keep them operating steadily at peak efficiency, insist on the trademark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.





How **JOY MANUFACTURING CO.** mounts the rotary table and gear shaft of its Super Heavyweight Champion rotary airblast drill on Timken bearings to cut gear wear and maintenance, get longer gear life.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS ROLL THE LOAD